SEPTEMBER
1959
VOLUME 8
NUMBER 9

Battelle Technical Review

IN THIS ISSUE:

Optical Effects in Semiconductors

VIGNETTE

DAVID C. MINTON, JR.

Students of the kaleidoscopic changes in technology, spokesman on behalf of scientific research, realistic analyst of the potential implicit in research—these are facets of Battelle's David C. Minton, Jr.

The desire to advance research has led Dave over the past two decades into many areas of concern to science and technology. Recognition of the experience thus gained takes varied form. Just last month he was named to the Materials Advisory Board of the National Academy of Sciences—National Research Council. This month, on invitation, he addresses the annual meeting of the American Mining Congress.

Service in the cause of research is not new for Dave. During World War II, he was called by the War Metallurgy Committee of NAS-NRC and War Metallurgy Division of OSRD to help administer the critical wartime research program—for which he was awarded the Armed Forces Certificate of Appreciation.

During his first year (1941) at Battelle, Dave was deep in research. He participated in important studies, including new uses for the uncommon minerals, an evaluation of magnesium-recovery processes, and new uses for copper. Shortly, however, his participation in those studies was to be terminated for the Washington assignment.

In 1945, Dave returned to Battelle and in 1949 took over the guidance of its project development and sponsor relations program. This responsibility has led to improved systems for coordinating and administering research projects. Later, he participated in the establishment of laboratories in Frankfurt and Geneva and the formulation of their philosophy and procedures for conducting contract research. Their soundness has played a vital part in the acceptance of the concept of contract research in Europe.

Over the years Dave's understanding of technological conditions, both nationally and internationally, has broadened and deepened. As vice president and member of the Institute's executive committee, his knowledge has been most useful in setting the Institute's course, in adjusting its operation, and in determining areas of greatest research potential.

Increasingly, he has been called upon to participate in the activities of other organizations. Currently he is a member of the Committee on International Affairs and the Editorial Advisory Board of the Atomic Industrial Forum and of the NAM Committee on Research.

Dave graduated from the University of Arizona in 1930 with a bachelor's degree in mining engineering. A master's degree in metallurgy followed. Then came associations with mining and metals firms both here and in Mexico, the U. S. Geological Survey, and his Alma Mater. Just prior to coming to Battelle, he was professor of metallurgy at the University of the Philippines, where he organized the metallurgical curriculum. In 1948, his Alma Mater awarded him the professional degree of metallurgical engineer.

Dave and his wife, Betty, and son, Dave III, have quite a reputation as sailors in the Thistle class of racing sloops. And from this sailing interest, Dave III has moved to submarines, via the U. S. Naval Academy.

BATTELLE TECHNICAL REVIEW

VOLUME 8 • NUMBER 9 • SEPT., 1959

CONTENTS

Inside front cover — David C. Minton, Jr.
Vignette

2 — Encouragement of Creativity
Commentary

3 — Materials Beneficiation Enters New Fields
by ADAM L. WESNER

Beneficiation has long been identified with the minerals industry. The author describes how established and new techniques can benefit other areas of technology.

7 — Optical Effects in Semiconductors
by THEODORE S. SHILLIDAY

The author centers his discussion on the infrared region of the electromagnetic spectrum. He describes the effects of radiation upon semiconductor devices, discusses the devices of interest in the area, and points out how the phenomena of radiation are used in solid-state research and in technology.

14 — Candidate Ceramic Nose Cones

15 — Notes from Battelle

Reports on research activities and developments of interest to science and industry

18 — Writings by Staff Members

Papers and articles prepared by members of the Battelle staff that have appeared recently in books and periodicals

493a — Battelle Technical Review Abstracts

Abstracts of articles and papers in a wide variety of technological fields from more than 1350 journals published throughout the world. Abstract selection largely reflects primary areas of Battelle research.

Dedicated to the dissemination of knowledge. Published monthly by Battelle Memorial Institute, an endowed foundation serving mankind through science and technology.

Please address all correspondence about articles, abstracts, subscriptions, and exchanges to: The Editor, Battelle Technical Review, Battelle Memorial Institute, 505 King Avenue, Columbus 1, Ohio.

Accepted as controlled circulation publication at Columbus, Ohio.

Printed in U. S. A.

Encouragement of Creativity

Those who are called upon to stimulate research and to administer research programs are concerned with the question of how to foster (if it can be done) the creativity of those engaged in research. There appears to be no one answer to the question. Varied approaches are being tried—some with apparent success. These range from tangible awards for usable ideas to planned attention to the psychological intangibles that motivate men. More and more, however, it seems that the intangible factors—such as freedom of action, challenge, and recognition—are of greater significance in stimulating creative thought.

Permitting the creative person the greatest possible leeway for action appears to be vital. When objectives are stated broadly and the paths to their accomplishment not narrowly defined, the creative person is, in effect, given tacit encouragement to go beyond the conventional approaches. Often breadth in objectives brings results beyond all expectation.

Receptiveness to new ideas is most important in inspiring creative effort. Obviously, not all ideas of creative people merit endorsement and they are usually the first to recognize this. But certainly such individuals deserve thoughtful consideration of new concepts that emerge from their efforts.

A proper working atmosphere is a significant factor in encouraging creativity. It will reflect the expectation of sophisticated accomplishment, appreciation of the importance of what is being done, and the expectation that all concerned will give their best efforts.

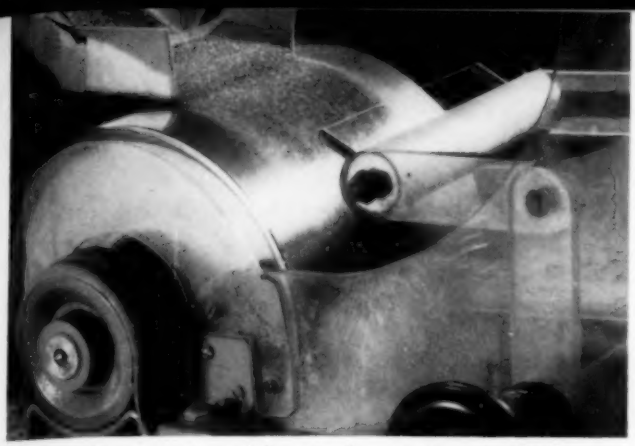
Freedom to exchange ideas is vital. Creative persons need new ideas and viewpoints to inspire and aid them in their work. But, at the same time, an exchange does not really take place unless one's knowledge can be shared with others.

Persons assembled to do creative work require frequent assignments that challenge their capabilities. Sharp minds can be dulled by pedestrian tasks. Assignments that combine intellectual challenge along with foreseeable benefit to society often inspire creative individuals to their greatest effectiveness.

Recognition of a person's accomplishments can be a paramount factor in encouraging the extension of his creative ability. Dollars are an obvious and expected reward. But a personal pat on the back and well-conceived group recognition may give more profound satisfaction. The ultimate recognition, of course, is frequently the mere act of granting a man opportunities for developing his own ideas.

Creativity is perhaps the rarest of human talents and most responsible for human progress. The nurturing of such a talent is rightfully a primary concern of those in a position to bring about its increase.

based upon a paper presented by **R. J. McCrory,** chief of Battelle's division of mechanical research, before the Ohio Society of Professional Engineers.



Electrostatic separation of fine-sized materials using high-tension drum.

Magnetic separation, carried out here in ultra-high-intensity apparatus.

Flotation methods, especially useful for concentrating fine-sized materials.

Gravity concentration, using the Humphreys spiral equipment.

Materials Beneficiation Enters New Fields

Beneficiation has long been identified with the minerals industry. The author describes how established and new techniques can benefit other areas of technology.

by Adam L. Wesner

According to Webster, "beneficiation" is a word that refers only to the concentration of ores. But the techniques of beneficiation, the methods which allow us to sort the prized diamond from the tons of worthless sand, are being used more and more to solve a host of industrial problems. Many of these problems apparently have no relation to those encountered in the concentration of ores, but the basic principles are similar. If the possibilities of the application of these principles were only recognized, however, they could be beneficial in many new areas where they are not now applied.

A distinguished mining engineer, with tongue in cheek, has proposed that those who practice beneficiation be referred to as "unscrambling engineers", a proposition which although perhaps slightly undignified is completely appropriate. Unscrambling, of course, applies not only to ores, but to the removal of dirt from food or pharmaceutical products, the separation of plastic from metal, ink from paper, and many similar applications which apply the techniques of beneficiation.

PHYSICAL PROPERTIES WIDELY USED IN MINERALS AND MATERIALS BENEFICIATION

Specific Gravity
Magnetic Susceptibility
Surface Characteristics
Electrical Conductivity
Resistance to Grinding
Particle Size and Shape

The widest and most successful applications of beneficiation are in the mineral industry inasmuch as low-grade ores must be treated at low cost. In the nonmineral industries, however, many potentially profitable applications of beneficiation exist, but are often not recognized. As our technology becomes more complex and diversified, the number of potential applications of beneficiation is growing, and it is increasingly important that they be recognized and studied for the advantages to be gained by their adoption.

Beneficiation is the enrichment of a material by sorting the valuable from the worthless components without significantly altering the inherent physical and chemical nature of either. A requisite of the process is that the parts be physically liberated from each other; thus, before beneficiation, a material may require grinding or some other form of particle size reduction to attain liberation.

From totally unsuitable mixtures, beneficiation produces end products that are suitable for direct use. It also serves to concentrate the desired components of low-grade crude material so that subsequent more costly processing can be performed economically on only a portion of the original volume of material. Beneficiation is a low-cost procedure. Generally the range of cost is from a fraction of a dollar to a few dollars per ton of material treated.

Techniques of Separation

In beneficiation processes, the differences between the various properties of the component parts of materials are used to achieve a physical sorting. The physical properties listed in the table above are widely used in beneficiating materials. The examples of separations listed in the table on page 5 suggest the techniques that are, or may be, employed in beneficiating a variety of materials and indicate the properties that may be utilized. Thus it can be seen that agricultural, industrial, and chemical materials can be improved as successfully by the techniques as are minerals.

A number of interesting and successful examples of beneficiation are discussed below. They suggest the variety of techniques that may be applied and point up the economic advantages that may result from such processing.

Recovery of Silver From Waste Photographic Material

Silver valued at over 3 million dollars is reclaimed annually, by one producer of photographic film, by treatment of spoiled or outdated film, trimmings, and worn-out movie film. The film is chopped and washed with a hot dilute alkaline solution to remove the gelatin coating from the film base. The wash solution is settled to produce a silver-bearing sludge. The sludge is smelted to produce metallic silver and a slag which contains inclusions of metallic silver. The silver remaining in the slag must be recovered in a small volume of material to assure economic operation of the entire reclamation procedure. Reclamation is accomplished by grinding and then beneficiating the slag. The procedures used are jigging* and flotation**. The jig and flotation concentrates are returned to the smelting operation for recovery of the silver. The success of the entire reclamation plant depends to a large extent on the economical disposal of the smelter slag by beneficiation.

*Jigging is a process that utilizes the differences in settling rate of particles of different specific gravities and sizes, in a very thick suspension of solid particles in water, in order to separate the heavy from the light.

**Flotation is a process that exploits differences in physical and chemical surface properties to cause one or more of the component materials to collect in a froth which is skimmed off to effect separation. Specific gravity is not a significant factor.

For almost two decades Adam Wesner has studied problems associated with the beneficiation of mineral and nonmineral materials. His principal current interest is the adaptation of such techniques for use with agricultural, chemical, and other industrial materials. Recently completed, for example, was an investigation of a process for separating bark from chipped pine waste wood, which he guided. Over the years Wesner's research has been concerned with most of the principal minerals mined in North America and with ores produced in other parts of the world. At Battelle, he has studied beneficiation processes for ores of metals including aluminum, columbium, rare earths, tin, tungsten, and zirconium. He has reported the results of a number of these studies in the technical literature.

EXAMPLES OF SEPARATIONS BASED ON DIFFERENCES IN PHYSICAL PROPERTIES

Separation or Potential Separation	Physical Properties*	Processes
Resin rubber from milkweed	Surface characteristics	Flotation
Ergot from rye	Surface characteristics	Flotation
Ink from waste paper pulp	Surface characteristics	Flotation
Fiber from rubber	Resistance to grinding	Shredding, grinding, screening
Wheat hulls from kernels	Surface characteristics	Flotation
Bark from wood chips	Specific gravity	Float and sink
Heartwood from sapwood	Specific gravity	Float and sink
Sewage from water	Surface characteristics	Flotation
Diamonds from waste	Electrical conductivity, specific gravity, surface characteristics	Electrostatic separation, float and sink, flotation
Lead from storage battery scrap and trimmings	Size, shape, specific gravity	Screening, float and sink
Oil from refinery water	Surface characteristics, specific gravity	Flotation, centrifugal separation
Enamel from spray booth residue	Size, surface characteristics, magnetic susceptibility	Screening, flotation, magnetic separation
Weeds from seed	Electrical conductivity, shape, size, specific gravity	Electrostatic separation, screening, air classification, float and sink
Silicon carbide from waste	Electrical conductivity, magnetic susceptibility	Electrostatic separation, magnetic separation
Extraneous materials from beans, grains	Specific gravity, electrical conductivity	Float and sink, electrostatic separation
Bacteria from water	Surface characteristics	Flotation
Platinum from refractory	Specific gravity, surface characteristics	Jigging, tabling, flotation
Metals from slag or scrap	Specific gravity, resistance to crushing, electrical conductivity	Jigging, tabling, float and sink, crushing, screening, electrostatic separation
Napthalene from coke-plant cooling water, also separation of other organics	Surface characteristics	Flotation
Debris from cullet	Specific gravity, electrical conductivity, magnetic susceptibility.	Jigging, tabling, electrostatic and magnetic separations
Plastic from scrap	Electrical conductivity, specific gravity, shape, size	Electrostatic separation, float and sink, screening
KCl from Na_2SO_4 or NaCl, also separation of other water-soluble salts	Surface characteristics	Flotation
Fatty acid from water	Surface characteristics	Flotation
Lithium phosphate from alkaline brine	Surface characteristics	Flotation
Silver from photographic materials	Specific gravity, surface characteristics	Settling, jigging, flotation
Grit from starch	Size, specific gravity	Centrifugal separation
Gluten from starch	Size, specific gravity, surface characteristics	Centrifugal separation, flotation
Peas from nightshade berries	Surface characteristics	Flotation

*Differences in the physical properties listed are the potential bases for separation

Separation of Cord from Rubber

In the production of automobile tires, several layers or piles are used to build up the carcass. Each layer is made up of parallel cords encased in rubber. The scrap trimmed from the built-up tire is still not vulcanized. But, because of the cord, its value is of the same low order as reclaimed vulcanized rubber.

Separation of the cord from the rubber was attained by shredding the waste to about ½-inch maximum size, subjecting the shredded material to a grinding operation in a ball mill, and then screening the ground material. The cord was disintegrated by the grinding action to very short lengths which readily passed through the screen.

In this beneficiation procedure the value of the rubber was increased to that of virgin crude rubber. At present, the price of virgin rubber is about two times that of reclaimed, but the ratio has been as high as five to one.

Recovery of Waste Porcelain Enamel

In the production of porcelain enamel white ware, an enamel slip is sprayed on the surface, and the ware is then dried and fired. In the spraying operation, only about one-half of the slip adheres to the ware; the overspray, however, becomes contaminated with various impurities which preclude reuse.

The major component of the slip is a granulated finely ground glass called "frit". From 80 to 90 per cent of the frit can be recovered in a product suitable for reuse by beneficiation procedure including screening, magnetic separation, and flotation. In large enameling plants where the overspray may amount to 10 tons of frit per day, the projected economic return from beneficiation is on the order of $1000 per day.

Recovery of Lithium Phosphate

The saturated brine from Searles Lake, California, contains less than 0.05 per cent of lithia in the form of near-colloidal particles of dilithium sodium phosphate. If not removed, this extremely fine material causes considerable difficulty in the operation of the soda products process. Removal by filtration was found unsuitable because the rate of filtration was prohibitively low. The problem was solved by froth flotation; a concentrate containing 20 per cent of lithia was produced at high recovery. Thus, beneficiation served to eliminate a difficult plant problem and at the same time to produce a valuable by-product.

Other Properties Might Be Used

As technology advances, new techniques are being made available for beneficiation processes, and advantage can be taken of additional properties. From a technical standpoint, it should now be possible to use such properties as color, heat conductivity, radioactivity (inherent or induced), fluorescence, light transmission, and dielectric constant as bases for materials separation. The fact that differences are not evident or known does not mean beneficiation is impossible. Properties that are currently ill defined or that are now unknown can often be utilized to achieve spectacular success.

Steps to Utilization of Beneficiation

Minerals beneficiation engineers the world over are constantly seeking to improve older methods and to find new methods for improving ores and other materials. The mineral industry, highly cognizant of the need for beneficiation at low cost and of the large measure of success attained, turns to minerals beneficiation techniques as a matter of course when it is confronted with a separation which has not been made before. However, skilled and capable personnel, in industries outside the mineral field, often fail to take advantage of these low cost methods because the techniques which might be used are foreign to their experience. There is no doubt that potentially profitable applications of beneficiation exist in one or more areas for many industries. These may be:

a. Improving the quality of raw materials or making possible the use of less expensive materials.

b. Improving the final product.

c. Utilizing by-products.

d. Treating industrial waste materials to remove objectional contaminants and/or to produce salable by-products.

In order to profit most fully from these potential opportunities, personnel in the nonmineral industries must actually seek and discover them. The most effective procedure is to encourage the administrative and technical staff in each plant to make a critical examination of their raw materials, intermediate products, fiinal products, and all waste products, to look for mixtures of "goats" and sheep". When these are unscrambled, improvements or new utilizations such as were outlined in the previous paragraph may result. A broad outlook should be taken; the illustrations given in this paper provide only a few typical examples. However, many more exist, and opportunities are offered by others still undetected.

After the potential separations are recognized, the problem of developing technically and economically feasible procedures can be studied either by the plant personnel or by specialists in materials beneficiation from outside the company.

Optical Effects in Semiconductors

The author centers his discussion on the infrared region of the electromagnetic spectrum. He describes the effects of radiation upon semiconductor devices, discusses the devices of interest in the area, and points out how the phenomena of radiation are used in solid-state research and in technology.

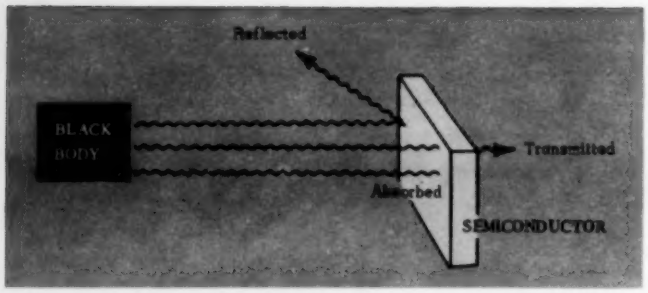
by THEODORE S. SHILLIDAY

IN THE ELEVEN YEARS since the invention of the transistor, semiconductors and semiconductor devices have become an important factor in the world's electronics industry. The transistor is also largely responsible for having provided initial stimulus to an amazingly fruitful effort in fundamental research on the solid state. A large part of the fundamental research on semiconductors is the study of energy relationships within crystal lattices. As might be expected, many of these studies are carried out by applying energy by one of several means to a semiconductor sample and observing the effect of this energy input on some pertinent property of the sample. Among sources of energy in common use are heat, electrical fields, mechanical pressure, nuclear radiation, and electromagnetic radiation. From the observable effects of these various types of energy, either singly or in combination, many powerful tools for solid-state research have evolved. The observed phenomena are forming the design basis for a continually growing list of semiconductor devices.

The principal purposes of this paper are to explain some of the phenomena which occur when electromagnetic radiation is incident upon a semiconductor crystal, to point out ways in which these phenomena are utilized in solid-state research, and to discuss some of the semiconductor components which result from practical application of these phenomena. Attention will be directed to only a limited portion of the electromagnetic spectrum; the infrared, and to a lesser extent the visible. This is not to say that other portions of the spectrum are not useful or important in relation to semiconductors. However, because of certain properties of semiconductor materials, the infrared has been a particularly useful region in research. Moreover, these same properties and their usefulness in military infrared detectors have made this region of the spectrum a particularly prominent one for photocell development.

ABSORPTION PROCESSES IN SEMICONDUCTORS

Figure 1 shows a slab of semiconductor with radiation from a black body incident upon one of its surfaces. A black body is, by definition, an ideal source of radiant energy, the spectral distribution of which depends only on the body's temperature. The radiation is shown in the form of waves, but it is more appropriate to think of it as a stream of separate bits of radiant energy called "quanta" or "photons". As shown in the figure, when a semiconductor sample is so irradiated, some of the energy striking the surface will be absorbed by the sample, some will pass through the sample, and some will be reflected by it. Which of these phenomena occur, and their relative magnitudes, will depend on the wave length of the radiation in question and on the properties of the sample being irradiated.



1. *The three things that can happen when radiation is directed upon a semiconductor.*

An ideal semiconductor crystal may be depicted, as shown in Figure 2, by an electron energy level diagram that includes a lower band of allowed energy levels, called the valence band, which is completely filled with electrons at 0 Kelvin; a band of energy levels wherein occupancy by electrons is forbidden; and a higher band of allowed energy levels, the conduction band, which contains no electrons at 0 Kelvin. This concept of the electron energies in semiconductor crystals is useful in discussing the absorption processes to be considered. Actual semiconductor crystals always contain residual or deliberately added impurities and lattice defects of various types. (The concentration of these impurities and defects may be made extremely low in some cases; i.e., one impurity atom for every 10 billion atoms of the host material.) The importance of these impurities lies in the fact that they introduce energy levels which may lie within the band of forbidden energies of the crystal. Depending upon their nature, such levels may contribute electrons to the conduction band (donors) or accept electrons from the valence band (acceptors) as shown in Figure 2. Electrons in the conduction band can move under the impetus of an electric field and thereby contribute to the electrical conductivity of the crystal. The same applies to "holes" in the valence band. A "hole" is an electron deficiency created in the valence band when an acceptor impurity accepts an electron from the valence band or when an electron is excited or caused to jump from the valence to the conduction band.

The excitation of an electron from the valence band to the conduction band is an intrinsic process i.e., a characteristic of the pure material. Each such transition or excitation produces one free electron and one free hole. The excitation of an electron from a donor level to the conduction band produces one free electron and one bound hole (bound at the site of the ionized donor). Similarly, the excitation of an electron from the valence band to an acceptor level produces one free hole and one bound electron (bound at the site of the acceptor).

Each of these transitions can take place by the absorption of thermal energy from the crystal lattice or by the absorption of electromagnetic radiation, provided it is of the proper wave length.

The energy associated with a photon of electromagnetic radiation of wave length λ is given by

$$E = \frac{hc}{\lambda}$$

where h is Planck's constant and c is the velocity of light. The long wave length limit for an absorption process in a semiconductor involving an electron transition between levels separated by an energy difference $\triangle E$ is given by

$$\lambda_{11m} = \frac{1.24}{\triangle E}$$

where λ_{11m}, the long wave length limit, is expressed in microns and $\triangle E$ is expressed in electron-volts.

Infrared or optical absorption in semiconductors can be categorized into four types: intrinsic or fundamental absorption, associated with transitions of electrons across the forbidden energy gap of the material; impurity absorption, associated with electron transitions between impurity levels, and the valence or conduction band; absorption by free carriers (electrons in the conduction band or holes in the valence band); and absorption due to the excitation of lattice vibrations.

Fundamental Absorption

When a photon of radiation with energy equal to or greater than the energy gap strikes a semiconductor, it will be absorbed by passing its energy on to an electron in the valence band of the material. Having absorbed the energy, the electron will jump across the

The author is closely associated with studies on the optical properties of semiconductors and infrared detectors. In recent years, extended investigations concerned with the applications of thermoelectric phenomena in semiconductors and the development of galvanomagnetic devices have engaged his attention. Shilliday has also conducted research on semiconductor rectifiers. Author of more than a dozen papers growing out of his studies at the Institute, he is an active member of the American Physical Society and the American Institute of Electrical Engineers.

band of forbidden energies into the conduction band. An incoming photon that has energy less than that of the band gap cannot transfer its energy to a valence band electron and, in the absence of other processes, will pass through the material as transmitted radiation. Therefore, by directing monochromatic radiation of varying wave lengths (and hence varying photon energies) upon a sample of semiconductor material and observing the wave length at which transmission through the sample begins, the scientist can determine qualitatively the width of the forbidden energy gap of the material. The same general sort of determination can be made by applying an electric field to the sample during irradiation and measuring the change in electrical conductivity in the sample as a function of wave length. Figure 3 shows qualitatively the sort of curves obtained from such measurements.

The "absorption edge" in a material is located in the wavelength or photon energy region where sudden large changes are observed in transmission or photoconductivity. It is related to the width of the forbidden energy gap of the material. The width of the forbidden energy gap of a semiconducting material is an important intrinsic property and, hence, it is essential to the characterization of the material and to its application in practical devices.

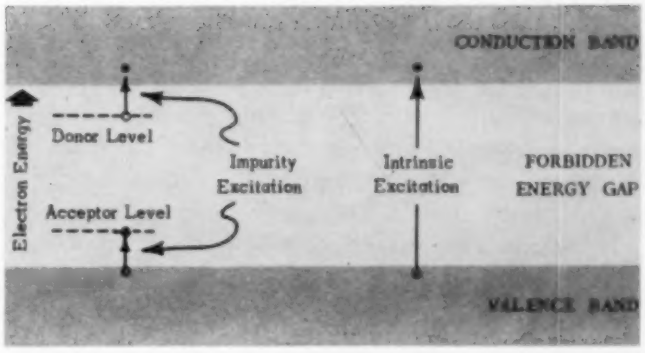
Impurity Absorption

Absorption by an impurity in a semiconductor results in an electron transfer between an impurity level and the valence or conduction bands. Since energies involved in these transitions are generally small compared to the intrinsic activation energy, the cutoff for impurity absorption processes occurs at longer wave lengths. Thus, impurity absorption will make itself evident in a plot of transmission or absorption coefficient on the long wavelength side of the fundamental absorption edge.

Free Carrier Absorption

Free carriers (electrons in the conduction band and holes in the valence band) have many levels of higher energy available to them. Excitation to these levels requires only very small amounts of energy. If free carriers are present in a material in sufficient concentration, they can cause strong absorption in the long wave length regions of the infrared spectrum. Free carriers may arise in the material from impurities that are thermally ionized at the temperature at which the sample is held or from intrinsic carriers if the forbidden energy gap of the material is small and the temperature of the sample is too high.

The presence of free carriers in a semiconductor has important fundamental, as well as practical, implications. If the density of free carriers is too high, it may be difficult or impossible to get useful data from optical measurements on a sample. In a radiation detector made from material with too high a free carrier density, the number of carriers excited by the radiation to be detected may be so small relative to the number already present that the cell will have little or no sensitivity. In an infrared window or lens made from material with too high a free carrier density, transmission properties are seriously impaired.



2. *Schematic of the energy-band structure of a semiconductor illustrating the excitation of charge carriers.*

Lattice Absorption

It is well known that the atomic nuclei making up a solid crystal oscillate about their equilibrium positions in the crystal lattice and that these oscillations occur in certain modes and at frequencies which depend upon the atoms in question and on the binding energies holding the crystal together. In semiconductors, interactions between infrared radiation and the vibrational energy spectrum of the crystal lattice sometimes result in the observance of lattice absorption bands in spectral transmission data on a material.

This has been a simplified explanation of the optical absorption processes occurring in semiconductors. Among the principal optical measurements made on semiconductors are transmission, reflectivity, and photoconductivity as functions of wave length and temperature. From the former two quantities, it is possible to calculate absorption coefficients which, with the aid of theoretical considerations relating to the absorption processes discussed, lead to much information regarding the fundamental properties of the materials. Still more information can be obtained by coupling optical data with that obtained using electric and magnetic fields and pressure.

Devices and Applications

Some of the optical phenomena in semiconductors which have been described, and others which have not

been touched on specifically, provide the basis for design of a variety of useful semiconductors devices. These may be divided broadly into active and passive classes of components. The active class would include radiation-actuated devices, such as those based on the photosensitivity of a material, and radiation-generating devices, such as those utilizing luminescent materials. The passive class would include optical components that utilize particular transmission and absorption properties of a material in the function of windows, lenses, and filters for the infrared and other portions of the spectrum.

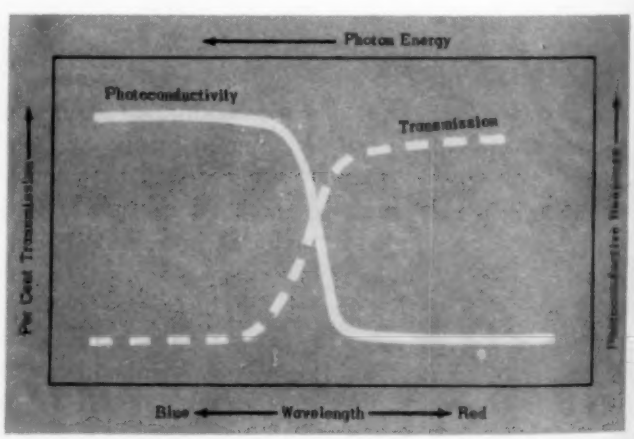
Radiation-Actuated Devices

As has already been indicated, the density of free carriers in a suitably pure sample of semiconductor material held at a sufficiently low temperature can be significantly altered by the absorption of electromagnetic radiation. The increase in the density of free carriers as a result of photon absorption brings about an increase in the electrical conductivity of the sample. This increase in conductivity can be measured electrically and, thereby, the radiation incident on the sample can be "detected".*

It was seen in earlier sections of this paper how the spectral sensitivity of a semiconductor photocell is dependent upon the width of an energy gap in the semiconductor. (Depending on cell design, this could be the intrinsic energy gap of the semiconductor or an impurity energy gap.) Thus, different semiconductors can be used to make photocells with sensitivity cutoffs at different points in the spectrum, depending upon their band gaps.

The chart on the next page shows the approximate position in the spectrum of the photosensitivity threshold of a number of the currently important semiconductor materials. With two exceptions, values shown are for room temperature. For sensitive operation in the infrared, it is usually necessary to cool the cells, which, with certain exceptions, causes the cutoff to shift to shorter wave lengths. It will be noted that the majority of the materials cut off in the infrared region of the spectrum. This does not mean that many of the materials will not also respond to visible radiation, since it is of higher photon energy than the longer wave length radiation. However, such cells usually exhibit a peak in sensitivity near the spectral cutoff. It is, therefore, often desirable to choose for a detector a material that has its cutoff near the point in the spectrum where maximum response is desired.

The value of semiconducting materials for the development of highly sensitive infrared detecting elements, coupled with their importance to military applications and the research support which these applications have provided, have made infrared detectors the most widely exploited of the possible semiconductor photocells. For military purposes, infrared systems can be used for guidance, seeking, fire control, and imaging in somewhat the same way that radar performs these functions. For these purposes, infrared has the advantage of providing a passive system (radar usually involves sending out a signal and observing its reflection from the target) much less susceptible to jamming than radar. With infrared, the energy to be detected is that radiated by the target itself to its surroundings. Infrared, by virtue of its shorter wave

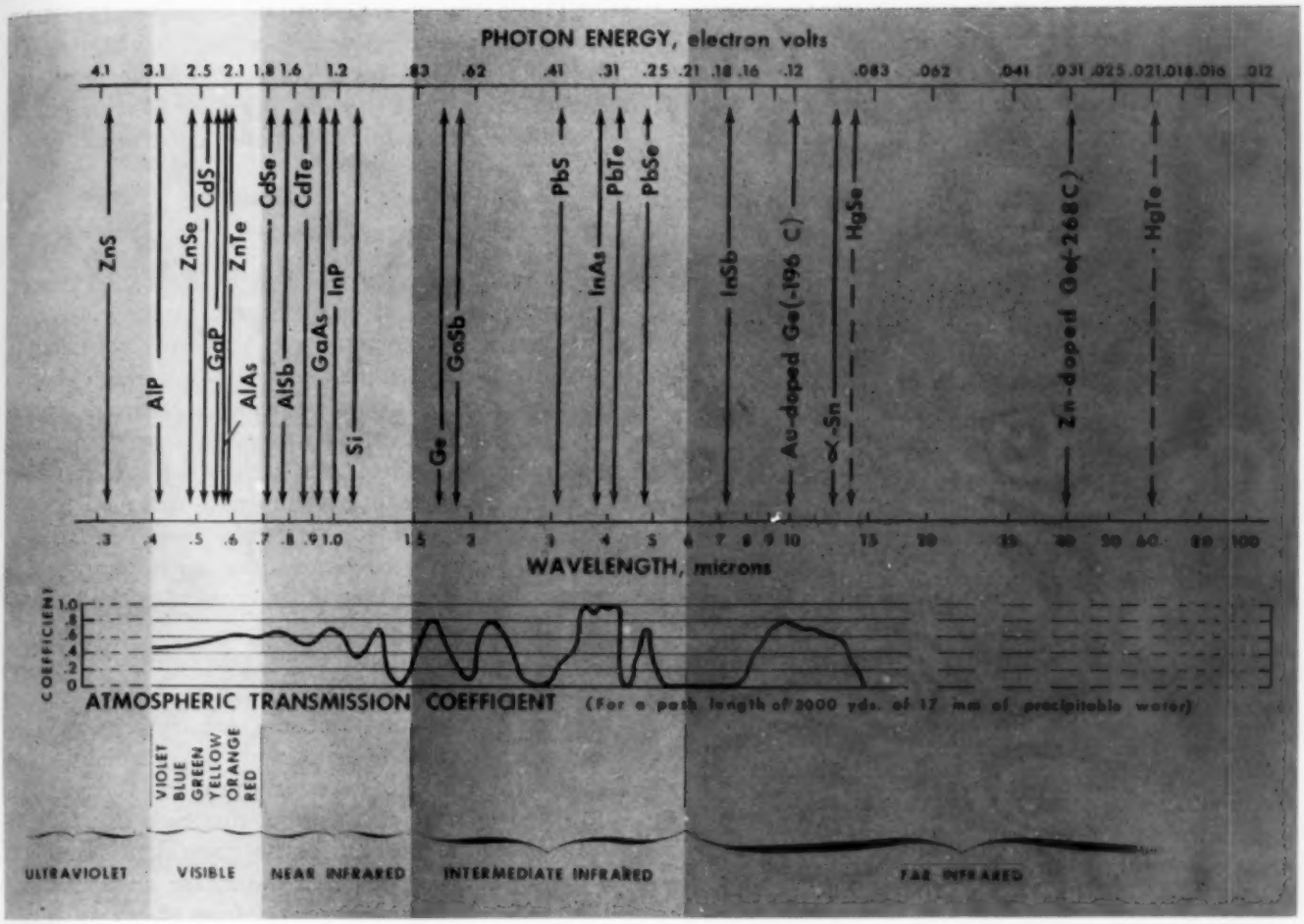


3. *Qualitative examples of spectral photoconductivity and transmission in a semiconductor. To obtain the former, an electric field is applied to the semiconductor sample during irradiation.*

*This is one of four phenomena in semiconductors upon which radiation-actuated or photosensitive devices are based. To list them all, there are:

1. The photoconductivity type in which an electric field is applied to a semiconductor element, and incident radiation causes an increase in conductivity through an increase in charge carrier density.
2. The photodiode type wherein the leakage current across a reverse-biased rectifying junction is increased by incident radiation.
3. The photovoltaic type wherein incident radiation produces electron-hole pairs at a rectifying junction, which become separated through charge carrier concentration gradients in the vicinity of the junction and thereby create an electric potential at the terminals of the cell.
4. The photomagnetoelectric type wherein radiation is incident on a semiconductor element in a direction perpendicular to a magnetic field in the element. The electron hole pairs produced by incident radiation diffuse through the element. The presence of the magnetic field causes the electrons and holes to be deflected in opposite directions thereby creating a detectable potential difference at the output terminals of the cell which are situated in a direction perpendicular to the directions of the incident radiation and the magnetic field.

Each of these types of cells has its own peculiarities in the way of speed of response, noise, sensitivity, circuit impedance, and difficulty of manufacture. The remarks to follow will not make reference to specific types of detector cells but will cover the features and functions achievable in photosensitive devices as a general class.



Shown are the approximate positions in the spectrum of the intrinsic absorption edge at room temperature for many of the currently important semiconductors and of an impurity absorption edge for Au-doped and Zn-doped Ge. The broken lines indicate uncertainty in forbidden energy gaps. Designations of the compound semiconductors are placed horizontally in groups according to their cation constituent; the relative positions of groups are of no significance. Note that with a given group, e.g. InP, InAs, InSb, with an anion constituent of higher atomic weight from a given group of the Periodic Table, the intrinsic absorption edge of the compound shifts to longer wavelengths (or the intrinsic energy gap becomes narrower). This illustrates an orderly dependence of basic semiconductor properties on the valence habits of constituent atoms and makes evident the possibility of tailoring materials for increasingly numerous functions as more complex compounds come under study.

length, has the further advantage of providing higher resolution than radar. Of course, infrared is not the answer to all such problems; it has some disadvantages as well. Notable among these are atmospheric absorption and difficulty with background noise as detection is extended to longer wave lengths.

At present, lead sulfide, lead telluride, and lead selenide are probably the most widely investigated and generally available infrared detectors. As can be noted from the chart, their response does not extend very far into the infrared. In order to reduce thermal noise, it is almost always necessary to cool infrared detectors during operation. The most widely used coolant for detectors operating in the near and intermediate infrared is liquid nitrogen. When the above lead compounds are thus cooled, their sensitivity threshold shifts slightly toward longer wave lengths. This shift is generally a beneficial one, since it makes the materials sensitive to radiation from a greater portion of the spectrum.

The continuing requirements of military applications are for more sensitive detectors and for detectors that will respond to radiation of longer wave lengths. The latter requirement stems from the fact that the peak of the radiant output of a body shifts toward longer wave lengths as the temperature of the body drops. The wave length, in microns, at which the peak in the black-body curve occurs is given by Wien's Displacement Law,

$$\lambda_m = \frac{2898}{T}$$

where the constant is the black-body constant in micron-degrees and T is the temperature of the body

on the Kelvin scale. Thus, radiation from a body in the vicinity of room temperature peaks at about 10 microns.

The systematic investigation of intermetallic semiconductor compounds, which was initiated about 1952, and the extensive research carried out on germanium before and since that time, have added three new detectors to the list of those in or nearing production. These are indium antimonide, which has a room-temperature sensitivity threshold at about 7 microns, gold-doped germanium, with a sensitivity threshold at about 10 microns (at the temperature of liquid nitrogen) and zinc-doped germanium with a sensitivity threshold at about 40 microns (at the temperature of liquid helium). Cooling, also necessary for indium antimonide detectors, shifts the threshold of that detector to about 5.5 microns. The gold- and zinc-doped germanium detectors are examples of devices that function through photon absorption by an impurity.

As can be seen from the plot of atmospheric transmission coefficient on the chart, there is a transmitting band or "window" in the atmosphere between about 8 and 14 microns. Research effort is now being directed to the development of detectors sensitive throughout this window. One currently promising candidate for this purpose is mercury selenide. Another is mercury telluride-cadmium telluride alloy in which it appears possible to control the width of the forbidden energy gap by varying the proportions of the constituent compounds.

Infrared cells capable of responding to as little as 10^{-11} watts of energy are being made. Military applications of these detectors were mentioned above. Civilian applications are also numerous. They include aircraft anti-collision systems, burglar- and fire-alarm systems, remote temperature sensors, railroad car "hot-box" detectors, and others. In the visible region of the spectrum, cadmium sulfide and cadmium-selenide photocells have been commercially available for quite some time. They are used in headlight dimmers, automatic door openers, and in a variety of counting and control applications.

Aluminum antimonide, silicon, and the materials falling between them in the chart are all well suited spectrally for the conversion of solar to electrical energy. Silicon cells are already in use for this purpose. At about 10 per cent efficiency (roughly half of their theoretical maximum efficiency on the earth's surface), they can generate approximately 100 watts per square yard of cell surface area on a sunny day. U. S. satellite Vanguard I, which is currently in its second year in orbit, has radio transmitters powered by silicon solar cells. The cells are still functioning and are expected to continue to do so for many years. Such long-term operation would be impossible with a battery of reasonable weight without recharging. Of the other materials mentioned for solar energy conversion, each is still in an earlier stage of research. An evaluation of their full potentiality must await further developments.

Radiation-Generating Devices

The materials from which light-generation devices are made are, in general, more complex chemically and physically than the materials that have, thus far, been discussed. The devices function through charge-carrier transitions in solids. However, the details of the phenomena involved are more complex and less well understood theoretically than those which have been discussed. Mention of them is included here in the interest of completeness and because they are now, and will probably continue to be, more prominent in consumer products than other types of optically sensitive devices.

The materials used in light-generating devices are materials that exhibit luminescence of one sort or another. Zinc sulfide is the only such material included in the chart that is of current commercial importance, although the necessary properties have been observed in some of the other materials listed.

Probably the most universally prominent example of a light-generating device is the screen on a television tube which converts the energy from electrons striking it into optical energy in the visible region of the spectrum (cathodoluminescence). In the illumination field, electroluminescent panels have received considerable publicity. In this type of device, an electric field applied across a layer of suitable material causes the layer to emit visible radiation. A few of the current-model automobiles and some other consumer items are now using electroluminescent materials for instrument lighting. Efficiencies are approaching the point where some general illumination applications can be considered.

These phenomena and the materials which exhibit them hold promise for many new and intriguing devices. The list must include flat-screen television display, light amplifiers, image storage screens, color-converting screens, counting and switching devices, and logic networks. Many of these have already been built and demonstrated in the laboratory.

Radiation-Transmitting Components

In designing and operating infrared systems, it is necessary to use various types of optical elements to collect, focus, and filter the incoming radiation. Mirrors or reflecting optics are widely used for some of these

functions. However, in some cases it is desirable, and in others necessary, to use a transmitting material for some such purposes. The factor of greatest importance in a material that is to be used as a window or a lens is that it be highly transparent in the wave-length region of interest. At visible wave lengths this has not been a difficult criterion to meet, since the visible region of the spectrum is quite narrow. The infrared spectrum, on the other hand, is a very broad one, and the problem of developing materials highly transparent over wide ranges in the infrared has been a difficult one. A variety of very useful materials for prisms and windows for scientific uses are now available. Many of them, however, are hygroscopic, soft, have poor thermal properties, and otherwise require special handling and carefully controlled environments. Such materials are of little or no practical value in military infrared systems where ruggedness and reliability are usually so important.

While semiconductor developments have not offered a complete solution to this problem, they have contributed one or two important additions to the list of available materials, and it may be expected that others will be added as time goes on. For such applications, of course, the semiconductor is used in its transmitting region on the long-wave-length side of the fundamental absorption edge. Thus, the variety of fundamental absorption edges represented by the different materials in the chart potentially offer wide selectivity in the transmission threshold of an optical component. It must be remembered, however, that the presence of free carriers in a semiconductor, which can be an indication of relatively low purity, seriously degrades transmission on the long-wave-length side of the absorption edge. Thus, in addition to fulfilling certain physical, thermal, and mechanical requirements, a semiconductor, to be useful as an infrared optical component, must have a fairly low charge-carrier density. At this point, only a few of the materials listed in the chart, notably germanium, silicon, indium antimonide, and cadmium telluride are sufficiently far advanced to meet this condition easily. Several others are approaching usefulness, and it may be expected that they too will soon be added to the list of infrared optical materials at the disposal of the equipment designer.

Conclusions

Much has been left unsaid about present-day devices and applications and about the future insofar as semiconductor materials are concerned. The chart includes mention of some two dozen semiconductor materials; only some of those are now under research investigation or in commercial use. The elemental semiconductors germanium and silicon have been extensively studied and are quite well understood. The systematic study of the binary semiconducting compounds is still in its infancy, yet products utilizing them are already on the market. Beyond this there are ternary, organic, and even more complex compounds which are known to be semiconductors and which, as the technology progresses, will add immeasurably to the scope and utility of solid-state electronics.

BLUEPRINTING WHAT SCIENCE CAN DO WITH OUR WORLD

"Should we not then—we men of science and technology in all countries—make every effort to find the means to enable a team of elite minds among us to prepare a blueprint that in broad but concrete terms will show all mankind what a wonderful place could be made of this planet? At this dramatic juncture we should feel that it is our duty to prevent the world from making its momentous choice blindly. There is, in fact, an obligation upon us to give to people of all nations a picture of the inspiring alternative offered by modern science and technology that can become a reality if the world is so resolved."

Edgar N. Schieldrop, University of Oslo

CANDIDATE CERAMIC NOSE CONES

Materials that will resist re-entry temperatures of over 10,000 F are needed to protect missile nose sections. No present materials can stand up long to such intense heat. But ceramic refractory materials, because of their properties, are promising, and they are being studied for use in cones designed to protect the nose sections.

These experimental ceramic cones, varying not only in shape and size, but in composition, were prepared at Battelle for evaluation in connection with the re-entry problem. Collin Hyde (left) and Herbert D. Sheets, Jr. (right) are members of a group that has worked with Winston H. Duckworth an development of the cones.

NOTES from BATTELLE

* HEAT-STORAGE FOR HOMES

Growing interest in the heat pump for use in year-round air conditioning for residences has raised the problem of curbing peak electrical loads in heat-pump systems. Such equipment will reach peak current loads on cold days when all other electric systems are also operating at a peak—considerably higher than the heating season average. High peak loads, which reduce the load factor (average load divided by peak load), can add much to the cost of supplying power. Increasing the load factor from 20 per cent to 30 per cent may reduce the total power cost by as much as one third.

Because heat storage offers a method of reducing such peak loads, a study of various systems has been made at Battelle for the Joint Heat Pump Committee representing the Association of Edison Illuminating Companies and the Edison Electric Institute. The investigation included effects of climate on storage requirements, heat-pump system arrangements, and heat-storage materials for use in such systems. Battelle technologists D. W. Lockin, J. W. Droege, J. J. Ward, and J. A. Eibling conducted the study.

Research indicated that heat storage appears to be more practical when placed on the condenser rather than on the evaporator side of the heat pump, since heat can be supplied to the storage by the pump itself or by resistance heating. However, it is pointed out that evaporator-side storage, while requiring greater initial expenditure for large storage capacity and larger heat-pump equipment, may be more economically operated under some conditions because it is supplied with "free" heat.

A variety of methods for heat storage were investigated and some preliminary conclusions about them were reached. *Fused salts and refractory materials* are promising for such storage; their cost is relatively low and they can store heat to a temperature of 800 F. *Water* has many advantages—low cost, high heat capacity, low corrosivity, and excellent heat transfer. It also permits use of less expensive and less complicated heat storage systems. However, at temperatures above 212 F, pressure storage vessels obviously are needed. *Solids*, while not requiring leaktight containers, call for greater storge volume than water over the same temperature range. *Heat of fusion materials*, which undergo transitions between solid and liquid states in the required temperature range, appear to have certain advantages. However, they are either highly toxic or corrosive, have erratic behavior, and often lack stability after many cycles. *Paraffin waxes* appear most suitable for utilization of heat of fusion in the range from 100 to 130 F, but their present cost is a decided economic disadvantage. In general, the Battelle technologists found that high-temperature storage offers advantages because of compactness which results from the ability to supply heat to the storage system more frequently.

Further research and development will of course, be required before practical and economical heat storage means are integrated into residential heat-pump systems.

* MATERIALS TO CONTAIN FLUORINE

The high-energy needs of present-day rocketry have created great interest in fluorine as an oxidizer for fuels. Along with its advantages of higher specific impulse and smaller volume, however, are problems associated with its toxicity, low boiling point, and, especially, its high reactivity.

In a paper presented before the American Rocket Society's recent Conference on Propellant Thermodynamics and Handling at Ohio State University, Earl L. White and Frederick W. Fink discussed materials of construction for handling the oxidizer. They pointed out that though fluorine will react with all other elements except the noble gases (helium, neon, argon, kryton, and xenon), many of the common construction materials will give acceptable service at specified temperature levels.

Fluorine in its liquid form (—306 to —363 F) is more corrosive than the gas at room temperature. However, corrosion rates for liquid fluorine are relatively low for some metals because reactions are slowed by very low temperatures and because of the formation of protective coatings on the containing metals. At the low liquid temperatures, mild steel appears to be somewhat more resistant to corrosion than stainless steels. Aluminum, magnesium, copper, nickel, titanium, zirconium, and tantalum alloys also

show good resistance. Monel or nickel are usually chosen to handle liquid fluorine.

The resistance of various metals to gaseous fluorine is related to temperature. Nickel alloys can be used to 1200 F, aluminum and magnesium to 900 F, with thorium a possibility to 700 F. Pure iron has good resistance to 600 F, mild steels with low silicon content to 400 F, and titanium and zirconium to 300 F. Chromium plate is useful to 400 F and nickel plate to even higher temperatures. Silicon, vanadium, rhenium, and uranium on the other hand, are attacked even below room temperature.

Great variation in resistance is also found in nonmetallic materials. Alumina is highly resistant (to at least 1470 F), while glass, asbestos, and some cermets appear to have limited uses at lower temperatures. Most organic materials are not compatible with either liquid or gaseous fluorine. However, the fluorocarbons can be used in some applications, with Teflon giving best service. The use of carbon materials is not recommended.

In conclusion, White and Fink point out that the secret of successfully handling fluorine is cleanness of equipment and prevention of leaks.

* CERAMIC CLADDING FOR UO_2

Among the problems confronting nuclear-reactor designers are those of protecting various forms of uranium from chemical attack and of containing radioactive fission gases—both at elevated temperature conditions. Advances in ceramic technology growing out of Battelle research for the U. S. Atomic Energy Commission promises aid in solving these and other problems.

Institute technologists A. R. Smalley, W. C. Riley, and W. H. Duckworth have reported success in cladding uranium dioxide ceramic with a structurally sound, impervious ceramic made from aluminum oxide. The unique ceramic is capable of protecting uranium dioxide from corrosive attack and of containing fission gases at higher temperature conditions than has been possible previously.

A further advantage is also gained from the development. Particles of uranium dioxide clad with the ceramic can be dispersed in a suitable refractory matrix of such materials as graphite or beryllium oxide ceramic to make a structural fuel element. In this use, damage to the matrix from nearby fissioning uranium is prevented by the cladding barrier, and the need for a matrix material that is impermeable to fission gases is eliminated.

The cladding development resulted from use of a specially developed aluminum oxide powder, as well as from consideration of the effect of ceramic processing methods and conditions on the final microstructure of the cladding and core. The researchers believe that useful claddings of other refractory oxides, such as those of beryllium and magnesium, might be developed from dioxide or other forms of uranium on the same basis.

Several laboratory tests, including irradiation in the Battelle reactor, indicate that the cladding blocks the escape of fission products from the core and protects the UO_2 from oxidation to volatile U_3O_8 in high-temperature air.

* EURATOM—U. S. JOINT RESEARCH

A "first" in cooperative efforts to advance knowledge of nuclear power on both sides of the Atlantic came to light with last month's announcement that the Euratom—U. S. Joint Research and Development Board is sponsoring research at Battelle. Purpose of the research program is to extend technologists' understanding of heat transfer and vapor formation phenomena encountered in the use of power reactors, Dr. B. D. Thomas, president of the Institute, announced. Of the first three contracts awarded under the new joint research and development program, Battelle's was the first to be signed.

Knowlege sought in the theoretical study is "basic to both the physics and the engineering performance of light-water or organic cooled and moderated reactors," according to Dr. H. D. Nelson, who is directing the work at Battelle. Underlying this research program is the decision of the Commission of the European Atomic Energy Commission to build reactors to produce electrical power in Euratom conutries. "Heat transfer and vapor formation may greatly affect the over-all efficiency and economy of these reactor-powered generating stations," Nelson observed.

The Battelle program calls for the study of heat-transfer and vapor-formation conditions as they occur in light water and in organic liquids, both of which may be used as coolants and moderators in reactors. A high-pressure heat-transfer loop will be used during the study to simulate actual heat and boiling conditions in a reactor.

While the Euratom—U. S. Joint Research and Development Board has not selected specific reactor projects for participating nations, it is generally recognized that much research is needed now on the heat-transfer and vapor-formation problems. The current

research is an attempt to anticipate these problems before reactors are actually built in Europe to power electric generators.

Member nations of Euratom, a cooperative organization set up to bring atomic power to Europe, are Belgium, France, Germany, Italy, Luxembourg, and the Netherlands.

* RARE EARTH HANDBOOK

The Rare Earth Research Group, made up of the nation's principal producers of the rare earth metals and their compounds, has released a new handbook on "The Properties of the Rare Earth Metals and Compounds". It was prepared for the Rare Earth Research Group by the staff of Battelle.

The handbook brings together for the first time the most recently available data on the physical, crystal, chemical, mechanical, electrical, magnetic, nuclear, and thermodynamic properties of each of the 15 rare earth metals, as well as for yttrium, a metal closely associated in nature with the rare earths. In addition to the data on the 214 page handbook, a 114-item reference list of leading sources of information on the rare earths is included.

The new manual, priced at $10 per copy, can be obtained by writing the Rare Earth Research Group, in care of Battelle.

* PRESSURE PACKAGING OF FOOD

The pressure pack, when used for food products, can solve problems such as spoilage, air deterioration, and desiccation resulting from exposure of the food to air. It can also aid development of new products. But it would be a mistake, according to Dr. C. Giddey, of Battelle's Geneva laboratory, to assume that all the problems in pressure packaging of food are concerned with the package and that food deterioration can be neglected.

Speaking before a meeting of the International Aerosol Association in Zurich, Dr. Giddey pointed out that physical, chemical, and bacteriological problems are always present in a packaged food. A product to be pressure packaged must be physically stable for months, must have definite viscosity characteristics and must retain its color and attractive appearance during the period of usage. Chemical problems often met are concerned primarily with nonenzymatic browning of the product. Bacteriological problems in pressure packaging require careful control of sterilization techniques. The use of preservatives in the food, inert gases for packaging, or a high acid content can help solve these problems but often require considerable study.

Pressure packaging, Dr. Giddey concludes, represents an important development in food technology. However, significant technological and scientific efforts will be required to solve the many problems that are almost certain to arise.

* WELDING OF TANTALUM

Because of its excellent high-temperature properties and resistance to corrosion, tantalum is attracting attention as a heat-exchanger material for use with nuclear reactors. However, achieving the required properties and soundness in tantalum welds calls for studies of improved welding methods.

In research at Battelle for Los Alamos Scientific Laboratory, reported by S. M. Silverstein, J. N. Antonevich, R. P. Sopher, and P. J. Rieppel, successful welds were made of a small tube-to-header heat exchanger by means of the inert-gas-shielded tungsten-electrode arc process. During their study, the technologists found that weld porosity and large grains in the cast structure of arc-weld deposits could lead to service failure of the welds. The study revealed that porosity can be reduced by increasing the carbon content of the commercial metal or by melting the tantalum in an arc furnace before welding. The metallurgists found that grain size can be reduced as much as two-thirds by applying ultrasonic vibrations to parts being welded. They point out that further research is needed to overcome difficulties resulting from compositional variations in commercial tantalum and from grain enlargement in order to assure that sound welds may be made routinely.

* NEW USES FOR ROCKET MOTORS

As the cost of labor increases, the "power assist" per man also increases. A valuable source of energy, which has hitherto been little used except in the field of aviation, is the rocket. While ever larger rockets are being employed for flight propulsion, at the opposite end of the scale are smaller nonthrust rockets that are being used for laboratory tasks.

Battelle technologist Albert E. Weller presents the possibility that nonthrust rockets may be of great usefulness in nonpropulsion applications. Before such uses become widespread, however, he believes that more information is needed about such problems as the characteristics of heat transfer from a rocket jet and possible chemical effects from using rockets.

Among the possible rocket uses which Weller envisions are: stripping paint from metal bases; cutting and piercing nonferrous metals; glazing flame-sprayed ceramics to reduce their surface porosity; and as a heat source in the hot machining of metals. He also suggests that rockets may be effectively used as a driving source for jet ejectors or high-intensity whistles, for cleaning brush for emergency fire breaks, and even, possibly, to influence local wind movements.

✱ Over the years, the fumigants methyl bromide and ethylene dibromide individually have proved useful in controlling insects in stored commodities, in storage buildings, and in the soil. Recent studies at Battelle for Ferguson Fumigants, Incorporated, indicate that mixtures of the two may be even better as fumigants. Harold E. Kazmaier and R. Glen Fuller of Battelle's bioscience division have found that mixtures of ethylene dibromide and methyl bromide are more toxic to the confused flour bettle, a common grain insect, than methyl bromide alone. The mixtures kill more rapidly than either component, and may provide longer protection before reinfestation. These effects were found over a wide range of mixture compositions. The fiindings suggest that the desirable features of both ethylene dibromide and methyl bromide may be utilized to practical advantage by use of mixtures of these two fumigants.

✱ Battelle staff members named to important technical posts include: *F. L. Bagby,* program chairman, Structures and Materials Session, Annual Meeting, American Rocket Society; *J. M. Blocher,* chairman, Refractory Coatings Symposium, Fall Meeting, The Electrochemical Society; *P. J. Rieppel,* member, Ordnance Advising Committee in Welding of Armor, Ordnance Tank-Automotive Command, Detroit Arsenal; *O. F. Tangel,* chairman, and *R. J. Brison,* member, Concentration Committee, Minerals Beneficiation Division, American Institute of Mining, Metallurgical, and Petroleum Engineers; and *J. J. Tighe,* member, Committee E-14 on Mass Spectrometry, American Society for Testing Materials.

Writings by STAFF Members

Cobalt, June, 1959 contains the following articles by staff members:

Application of Dispersion Hardening to Cobalt. Earl F. Adkins and Robert I. Jaffee, pp. 27-30.

Cobalt with 1.0 volume per cent Cr_2O_3 showed only 4 per cent of the total creep elongation of pure cobalt after 250 hours at 500 C and 12,000 psi (8.4 kg/mm²) stress. Oxide particles size was found to be an important factor in obtaining oxide-dispersion strengthening. Cobalt-chromium-base-powder-metallurgy alloys containing intrinsic Cr_2O_3 dispersions exhibited improved tensile and creep properties over those of pure cobalt.

Is Cobalt in Short Supply? F. R. Morral, p. 16.

Cobalt is not in danger of short supply. At the present time, production well exceeds consumtpion. The "Cobalt Information Center" has sponsored a research program to develop desirable and unknown properties of cobalt and to investigate possible new uses.

High-Softening-Point Maleic-Modified Tall Oil Rosin Glycerol Esters. R. D. Bitting and E. E. McSweeney. *American Paint Journal,* July 13, 1959, p. 30 + 4 pages.

When maleic is first pre-esterfied with glycerol and then reacted with rosin in the presence of a small amount of phosphoric acid, considerably higher softening points are obtained. Under these conditions, tall oil rosin gives resins with softening points at least as high as gum rosin.

Titanium Alloys Today—How Commercial Alloys Compare. Paul D. Frost. *Metal Progress,* April, 1959, pp. 91-96.

Divided into alpha, alpha-beta, and beta types, commercial titanium alloys have widely varying properties. Alpha alloys have high strength and good oxidation resistance at elevated temperatures, but cannot be heat treated readily. Alpha-beta and beta alloys respond to heat treatment and are more formable than alpha alloys. Research and development programs will broaden applications.

Forging and the Space Age. J. H. Jackson and H. B. Goodwin. *Metal Progress,* July, 1959, pp. 65-71.

As one of the mainstays of American production, the forging industry has progressed with the times since drop forging was introduced in 1846. Today, the industry is faced with new challenges from changing technological trends. What they are, and what they mean to forging engineers, is set forth in this article.

Belt Grinding Titanium. Carl T. Olofson. *Light Metal Age,* June, 1959, pp. 6-7.

Successful grinding of titanium with abrasive belts depends on reducing its welding action to the mineral. This can be accomplished by lowering the temperature at the grinding point through adequate cooling. Successful grinding also requires controlled "fracture wear" of the abrasive grits in order to supply constant sources of cutting edges during grinding. Titanium sheet can be belt ground to close dimenisonal tolerances. The cost of grinding titanium is estimated to be 6 to 10 times that for stainless steel.

Members of the Battelle staff are authors of the recently published articles and books listed on these pages. In most cases, reprints are available from the Battelle Publications Office, 505 King Avenue, Columbus 1, Ohio.

BATTELLE
TECHNICAL
REVIEW

ABSTRACTS

Volume 8, Number 9
September 1959

Aeronautical Engineering 493a
Agriculture 494a
Biochemistry and Biophysics 494a
Ceramics and Concrete 497a
Chemical Engineering 500a
Chemistry—Analytical 503a
Chemistry—Inorganic and General 505a
Chemistry—Organic 506a
Chemistry—Physical 509a
Coatings 511a
Control Systems, Computers, and Systems Engineering 513a
Electrical Engineering 514a
Electrochemistry 515a
Electronics 515a
Engineering Economics 520a
Fluid Mechanics 521a
Food Technology 521a
Fuels and Combustion 522a
Geology, Geophysics, Mineralogy and Mining Engineering 522a
Graphic Arts 525a
Heat Power 525a
Information—Preparation and Dissemination 526a
Instrumentation 526a
Lubrication and Friction 527a
Mechanical Engineering 527a
Metallurgy 528a
Metals—Corrosion 530a
Metals—Extraction and Refining 530a
Metals—Finishing, Polishing, and Cleaning 531a
Metals—Foundry Practice 531a
Metals—Heat Treatment 532a
Metals—Mechanical and Physical Properties 532a
Metals—Mechanical Working 534a
Metals—Metallography, Transformations, and Structures 537a
Metals—Powder 540a
Nondestructive Testing and Quality Control . . . 540a
Nuclear Physics, Nucleonics, and Radiation 541a
Operations Research and Management Engineering . 543a
Ore and Materials Beneficiation 544a
Physics 545a
Plastics 546a
Pollution and Wastes 548a
Rubber and Elastomers 548a
Space Heating and Conditioning 549a
Textiles, Fibers, Leather, and Paper 551a
Welding and Joining 551a
Miscellaneous 553a

AERONAUTICAL ENGINEERING

9880* The Effect of Jet Noise on Aircraft Structures. General theory of structural vibrations excited by random loads; noise pressure field; mechanical impedance of the structure; panel tests; fatigue life estimates. ***B. L. Clarkson.*** *Aeronautical Quarterly,* v. 10, pt. 2, May 1959, p. 103-126.

9881* Note on the Forces That Act Near the Centre and the Tips of a Swept-Back Wing. The momentum equation is used to calculate the drag that acts near the tip of a semi-infinite swept-forward wing of constant chord that is at zero incidence to a uniform stream of incompressible, inviscid fluid. The drag is given as a function of wing section and angle of sweep and is shown to be unaffected by shaping the tip. The results may be used to calculate the drag that acts near the centre and the thrusts that act near the tips of a swept-back wing, provided that its aspect ratio is sufficiently great for the regions where the different forces act to be separated. Results are combined to estimate the spanwise extent of the forces. ***D. G. Hurley.*** *Aronautical Quarterly,* v. 10, pt. 2, May 1959, p. 127-144.

9882 Development of Aircraft Structure to Withstand Acoustic Loads. New techniques of experimental stress analysis uses a high-intensity siren. Results of the siren test program are shown to be verified by accelerated tests of production structures under jet-noise loading. ***Peter M. Belcher, Joseph D. VanDyke, Jr., and Arthur L. Eshleman, Jr.*** *Aero/Space Engineering,* v. 18, June 1959, p. 24-30.

9883 Trade-Off Considerations in the Design of Guidance Equipment for Space Flight. Examines problems in the interaction between guidance and propulsion essential for optimum performance of a system designed to fulfill a photographic graze mission in near interplanetary space. ***Charles J. Mundo, Jr.*** *Aero/Space Engineering,* v. 18, June 1959, p. 31-34.

9884 The Development of Dynamic Flight Simulation. Incorporation of the acceleration forces into the flight simulator. Aviation medical acceleration laboratory centrifuge. Dynamic flight simulator. X-15 simulation program. ***James D. Hardy and Carl C. Clark.*** *Aero/Space Engineering,* v. 18, June 1959, p. 48-52.

9885 Breaking the Producibility Barrier. I-II. A summary of Air Force projects on manufacturing methods. 2nd. Ed. v. I. unpaged; v. II. 344 pp. AMC Technical Report 58-1, ASTIA Documents Nos. 156065 and 156066. Oct. 1958. Directorate of Resources, AMC Aeronautical Systems Center, U. S. Air Force, Wright-Patterson Air Force Base, Ohio. (TL671 Un3.11b Over.)

9886* Emergency Escape From Tandem-Crewed Aircraft. Considers the nature and duration of escape warning and action with respect to incidents in which little time is available for the escape, particularly those occurring near to the ground. Measurements were taken of escape control operation, crew patter and movement throughout the sequences by an oscillograph, magnetic tape and cinephotograph record. ***R. E. F. Lewis.*** *Canadian Aeronautical Journal,* v. 5, no. 5, May 1959, p. 187-194.

9887 Gas Turbines for Aircraft. Purpose of the present volume is an attempt to bridge the gap between the mostly descriptive and elementary type of textbook and the more academic kind. ***Arthur W. Judge.*** 439 pp. 1958. Chapman & Hall Ltd., London. (TL709 J89g)

9888 Soviet Earth Satellites. Historical treatment on development of rocketry in Russia; present rocket and satellite design and instrumentation; data on Sputniks I, II, and III. ***O. K. Sapounov.*** *Institute of Petroleum Review,* v. 13, May 1959, p. 141-146.

9889* The Design and Construction of the Compressor for the 8 Ft. by 8 Ft. High-Speed Wind Tunnel at R. A. E. Bedford. I. Selection of the Design. II. Features in the Design and Construction. Deals with the reasoning which led to adoption of the final design solutions, and supporting experimental work including manufacture and testing of a 1/7

*Asterisks mark items that may be used in the Battelle Library only. None of the unbound materials listed are available for interlibrary loan.

scale aerodynamic model necessary to establish performance characteristics of the compressor before deciding final blade settings. ***L. J. Cheshire, J. Y. G. Evans, W. A. Goodsell, and P. H. W. Wolff.*** *Institution of Mechanical Engineers, Proceedings,* v. 172, no. 15, 1958, p. 549-584.

9890 Final Report on Extraction of Aircraft Stability Coefficients From Flight Test Data and Theoretical and Experimental Studies on Selected Problems of High Speed Aerodynamics and Dynamic Stability. A new statistical extraction method based on the maximum-likelihood parameter-estimation technique was developed. The theoretical and experimental aerodynamics study of steady and unsteady phenomena showed that self-supported oscillations of the flow pattern can occur at certain values of shock strength and frequencies. A successful shock wave generator and a dynamic balance were built and used. ***Lloyd E. Wilkie.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 57-723, Dec. 1957, 132 pp. (TL507 Un3.18w Vis.)

9891 Air Research and Development Command Technical Symposium. Papers presented July 9-10, 1959 at Statler-Hilton Hotel, Dallas, Texas, on propulsion, structural, electronic, and special-purpose materials for aircraft and missiles. *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 58-655, Dec. 1959, 494 pp. (TL507 Un3.18w Vis.)

See also: **10579** (rocket propulsion); **10661** (metals for weapons systems).

AGRICULTURE

9892 Some Observations on Soil Compaction Tests. The effects of implements and traction on the compaction of soil and a review of research studies directed toward solution of the problem. ***A. W. Cooper and M. L. Nichols.*** *Agricultural Engineering,* v. 40, May 1959, p. 264-267.

9893* Mineral Oil Overlay for Conservation of Plant Tissue Cultures. . . . used successfully by other workers for conservation of stock cultures of bacteria and fungi, mineral oil may also be used to conserve plant tissue cultures. Prolonged growth under mineral oil does not appear to affect the ability of carrot tissue cultures to grow subsequently on subculture in air. ***Samuel M. Caplin.*** *American Journal of Botany,* v. 46, no. 5, May 1959, p. 324-329.

9894* The Control of Plant Diseases by Chemotherapy. *J. E. Livingston and M. T. Hilborn.* *Economic Botany,* v. 13, Jan.-Mar. 1959, p. 3-29.

9895 Physico-Chemical Studies on Agricultural Sprays. I. General Principles of Incorporating Surface-Active Agents as Spray Supplements. II. The Phytotoxicity of Surface-Active Agents on Leaves of Apple and Plum Trees. *C. G. L. Furmidge.* *Journal of the Science of Food and Agriculture,* v. 10, May 1959, p. 267-282.

9896 The Raison d'Être of Secondary Plant Substances. Discusses insect repellants, attractants, and poisons which occur in plants, and the manner in which these substances affect insect population. ***Gottfried S. Fraenkel.*** *Science,* v. 129, May 29, 1959, p. 1466-1470.

BIOCHEMISTRY AND BIOPHYSICS

9897* Carcinogenic Studies on Water-Soluble and Insoluble Macromolecules. Certain water-soluble polymers, such as polyvinylpyrrolidone, polyvinyl alcohol, and dextran, elicit upon parenteral introduction into rats and mice, sarcomas originating from organs and tissues in which these macromolecular substances are retained and stored. ***W. C. Hueper.*** *AMA Archives of Pathology,* v. 67, June 1959, p. 13-41.

9898* The Problem of the Macromolecular Structure of Native Molecular Ribonucleic Acid in Solution. Denatured deoxyribonucleic acid and native ribonucleic acid reveal an important intensification of absorption in 6 M urea, which suggests the resemblance of native ribonucleic acid with denatured deoxyribonucleic acid rather than with deoxyribonucleic acid. (*In Russian.*) K voprosu o makromolekuliarnoi strukture nativnoi vysokopolimernoi ribonukleinovoi kisloty v rastvore. ***A. S. Spirin, L. P. Gavrilova, and A. N. Belozerskii.*** *Akademiia Nauk SSSR, Doklady,* v. 125, no. 3, Mar. 21, 1959, p. 658-661.

9899* The Chloroplast and Photosynthesis—A Structural Basis for Function. A general survey. ***Jerome J. Wolken.*** *American Scientist,* v. 47, no. 2, June 1959, p. 202-215.

9900 Analytical Microbiology. Papers presented before the Division of Analytical Chemistry, Symposium on Microbiological Techniques, 134th Meeting, ACS, Chicago, 1958. Microbiological assay of amino acids, vitamins, and antibiotics in tubes; theory of agar diffusion methods for bioassay; enzymatic methods in analytical chemistry; and immunological techniques. *Analytical Chemistry,* v. 31, June 1959, p. 970-985.

9901* Areal Contrasts in the Abundance of Hydrocarbon Oxidizing Microbes in Soils. Ethane oxidizing microbes were detected by three methods using soil samples from areas of petroliferous emanation. ***J. B. Davis, R. L. Raymond, and J. P. Stanley.*** *Applied Microbiology,* v. 7, no. 3, May 1959, p. 156-165.

9902* Cytochrome c Concentration in the Tissues of Normal and Tumor-Bearing Rats. Cytochrome c decreased progressively in the tissues of the rat bearing a Walker carcinosarcoma 256 as the tumor weight to body weight ratio increased. ***Ralph F. Kampschmidt, Mabelle E. Adams, and Wilma L. Goodwin.*** *Archives of Biochemistry and Biophysics,* v. 82, no. 1, May 1959, p. 42-49.

9903* The Initiation of Deoxyribonucleic Acid Synthesis in the Connective-Tissue Cell, With Some Observations on the Function of the Nucleolus. In connective-tissue cells derived from explants of rat-heart tissue, the lag period preceding the onset of synthesis of deoxyribonucleic acid lasts about 20 hours. Snythesis of both protein and ribonucleic acid occurred during the lag period. Labelling in radioautographs indicates that the synthesis of deoxyribonucleic acid is initiated at the nucleolus. ***H. Harris.*** *Biochemical Journal,* v. 72, no. 1, May 1959, p. 54-60.

9904* Turnover of Nucleic Acids in a Non-Multiplying Animal Cell. In rabbit macrophages which remain alive and motile *in vitro* for long periods but do not multiply, the amounts of ribonucleic acid and protein per cell remain constant. No synthesis of deoxyribonucleic acid and no turnover of deoxyribonucleic acid adenine or thymidine residues could be detected. A rapid turnover of ribonucleic acid occurred; however, the breakdown products of this turnover were reincorporated into ribonucleic acid with great efficiency. ***J. W. Watts and H. Harris.*** *Biochemical Journal,* v. 72, no. 1, May 1959, p. 147-153.

9905* Fractionation of the Virus of Foot-and-Mouth Disease by Chromatography on DEAE-Cellulose. One fraction fixes complement with the type specific antiserum, has low infectivity. The other fraction also fixes complement but is highly infective and is identical with the 20-mμ component of the virus. ***F. Brown and B. Cartwright.*** *Biochimica et Biophysica Acta,* v. 33, no. 2, June 1959, p. 343-346.

9906* Genetic Transformation. II. The Significance of Damage to the DNA Molecule. Results indicate a one-hit process for the loss of genetic activity of pneumococcal DNA. The length of a critical DNA segment essential to genetic activity of the traits studied was 8%. Only ultraviolet discriminates between the optochin and streptomycin resistance markers. ***L. S. Lerman and L. J. Tolmach.*** *Biochimica et Biophysica Acta,* v. 33, no. 2, June 1959, p. 371-387.

9907* Polynucleotides. VII. Interaction of Polyriboadenylic and Polyribouridylic Acids. The ordered complex formed by the interaction of polyriboadenylic acid and polyribouridylic acid has been found to dissociate at pH's <4.5 and >10. The interaction has been shown to be reversible. ***R. F. Steiner and R. F. Beers, Jr.*** *Biochimica et Biophysica Acta,* v. 33, no. 2, June 1959, p. 470-481.

9908* The Sensitivity of Bone Marrow Proteins of Irradiated Animals to Proteolytic Enzymes. Irradiation of rabbits with a dose of 1000 *r* increases the sensitivity of bone marrow proteins to proteolytic enzymes (pepsin and trypsin). The effect can be revealed within the first minutes after irradiation, being somewhat enhanced during the subsequent 12 hours. A second increase in sensitivity of bone marrow proteins to proteolytic enzymes has been recorded 6 and 13 hours after exposure to ionizing radiation. (*In Russian.*) Chustvitel'nost' belkov kostnogo mozga obluchennykh zhivotnykh k proteoliticheskim fermentam. ***R. E. Libinzon and I. A. Tseveleva.*** *Biokhimiia*, v. 24, no. 2, Mar.-Apr. 1959, p. 263-266.

9909* Symbols Accepted by the Journal ["Biokhimiia"]. A list of abbreviations by biochemical terms. (*In Russian.*) Priniatye zhurnalom oboznacheniia. *Biokhimiia*, v. 24, no. 2, Mar.-Apr. 1959, p. 382-384.

9910* Immunochemical Studies of Organ and Tumor Lipids. VI. Isolation and Properties of Cytolipin H. ***Maurice M. Rapport, Liselotte Graf, Vladimir P. Skipski. and Nicholas F. Alonzo.*** *Cancer*, v. 12, no. 3, May-June 1959, p. 438-445.

9911* The Usefulness and Limitations of Tumor Transplantation in Cancer Research: A Review. ***George Klein.*** *Cancer Research*, v. 19, no. 4, May 1959, p. 343-358.

9912* The Problem of Drug Resistance in Cancer Chemotherapy. ***Arnold D. Welch.*** *Cancer Research*, v. 19, no. 4, May 1959, p. 359-371.

9913* Studies in a Tumor Spectrum. VIII. The Effect of Mitomycin C on the Growth of a Variety of Mouse, Rat, and Hamster Tumors. Among 22 crystalline or purified antibiotics tested, mitomycin C was the most effective, having a marked inhibitory to complete inhibitory effect on 16 out of 29 various tumors. ***Kanematsu Sugiura.*** *Cancer Research*, v. 19, no. 4, May 1959, p. 438-445 + 1 plate.

9914* The Effects of 5-Fluorodeoxycytidine, 5-Fluorodeoxyuridine, and Related Compounds on Transplanted Mouse Leukemias. The 5-fluorinated pyrimidine derivatives, 5-fluorouracil (FU), 5-fluoroorotic acid(FO), 5-fluorouridine (FUR), 5-fluorodeoxyuridine (FUDR), 5-fluorocytidine (FCR), and 5-fluorodeoxycytidine (FCDR), showed activity against various transplanted mouse leukemias. ***Joseph H. Burchenal, Ezequiel A. D. Holmberg, Jack J. Fox, Sandra C. Hemphill, and Jere Anne Reppert.*** *Cancer Research*, v. 19, no. 5, June 1959, p. 494-500.

9915* The Hepatocarcinogenicity of Tannic Acid. Tannic acid is a selective poison of liver parenchyma. It is weakly carcinogenic and acts at a site distant from its application. ***B. Korpássy.*** *Cancer Research*, v. 19, no. 5, June 1959, p. 501-504 + 2 plates.

9916* Mechanism of Growth. I. Interrelation Between Deoxyribonuclease and Deoxyribonucleic Acid Synthesis in Nonmalignant Growth. ***Sam Brody and M. Earl Balis.*** *Cancer Research*, v. 19, no. 5, June 1959, p. 538-543.

9917* The Accumulation of Orotic Acid, Uracil and Hypoxanthine by *Escherichia coli* in the Presence of 6-Azauracil and the Biosynthesis of 6-Azauridylic Acid. Reports the finding of metabolities of nucleic acids which are produced by cells simultaneously with 6-azauracil riboside; these metabolites accumulate also in cells affected by 6-azauracil. Concludes that inhibition of uridine kinase may play a role in the mechanism of the cancerostatic effect of 6-azauracil and particularly of the riboside. ***J. Škoda and F. Sorm.*** *Collection of Czechoslovak Chemical Communications*, v. 24, no. 4, Apr. 1959, p. 1331-1337 + 2 plates.

9918* Comparative Study of the Different Degrees of Sensitivity to X-Rays of Normal Tissues and of Crown-Gall Tissues of *Scorzonera* Cultivated *in vitro*. The inhibiting effect of X-rays on the growth of crown-gall tissues is more lasting than on that of normal tissues. (*In French.*) Étude comparative des radiosensibilités de tissus normaux et de tissus de Crown-gall de Scorsonère cultivés *in vitro*. ***Robert Jonard.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 248, no. 19, May 11, 1959, p. 2807-2808.

9919* *In Vitro* Incorporation of ^{32}P Into Nucleic Acids of Lymphatic Cells. Effects of X-Irradiation and Some Other Agents. ***A. Sibatani.*** *Experimental Cell Research*, v. 17, no. 1, Apr. 1959, p. 131-143.

9920* Quantitative Cytochemical Studies on *Paramecium aurelia*. ***R. F. Kimball and T. Barka.*** *Experimental Cell Research*, v. 17, no. 1, Apr. 1959, p. 173-182.

9921* On the Chromosome Number of Man. The chromosomes were investigated in several reliable metaphase plates with the application of the colchicine and water-pretreatment squash methods. The consistent counts show the diploid number 46, without exception, in every plate studied. ***Sajiro Makino and Motomichi Sasaki.*** *Japan Academy, Proceedings*, v. 35, no. 2, Feb. 1959, p. 99-104.

9922* The Origin of Purine and Pyrimidine Deoxyribose in *Escherichia coli* Systems. An enzymatic method for determining the specific activity of the deoxyribose moiety of a deoxynucleoside that is labeled in both its base and sugar moieties is described. ***Marilyn R. Loeb and Seymour S. Cohen.*** *Journal of Biological Chemistry*, v. 234, no. 2, Feb. 1959, p. 360-363.

9923* The Origin of Purine and Pyrimidine Deoxyribose in T6r+ Bacteriophage. When *Escherichia coli* is infected with T6r+ bacteriophage in media containing glucose-1-C^{14}, it is found that the deoxyribose moieties of each of the four deoxyribonucleosides of the T6r+ deoxyribonucleic acid formed upon infection have the same specific activity. It is concluded that all deoxyribose is formed from glucose via the same pathway. ***Marilyn R. Loeb and Seymour S. Cohen.*** *Journal of Biological Chemistry*, v. 234, no. 2, Feb. 1959, p. 364-369.

9924* A Comparative Study of the Structures of Bovine and Ovine Pancreatic Ribonucleases. Two differences in sequence between the ribonucleases of the two species have been established. ***Christian B. Anfinsen, Stig E. G. Åqvist, Juanita P. Cooke, and Börje Jönsson.*** *Journal of Biological Cheimstry*, v. 234, no. 5, May 1959, p. 1118-1123.

9925* The Nucleotides in Normal Human Blood. The following nucleotides have been found in normal human blood: diphosphopyridine nucleotide, triphosphopyridine nucleotide, adenosine mono-, di, and triphosphate, and guanosine triphosphate. ***Charles Bishop, David M. Rankine, and John H. Talbott.*** *Journal of Biological Chemistry*, v. 234, no. 5, May 1959, p. 1233-1237.

9926* The Synthesis of Heparin by Slices of Mouse Mast Cell Tumor. C^{14}-glucose and S^{35}-sulfate are converted by mouse mast cell tumor slices into a mucopolysaccharide indistinguishable from heparin. ***Edward D. Korn.*** *Journal of Biological Chemistry*, v. 234, no. 6, June 1959, p. 1321-1324.

9927* Virus-Induced Acquisition of Metabolic Function. I. Enzymatic Formation of 5-Hydroxymethyldeoxycytidylate. ***Joel G. Flaks and Seymour S. Cohen.*** *Journal of Biological Chemistry*, v. 234, no. 6, June 1959, p. 1501-1506.

9928* Trace Nucleotides in Certain Ribonucleic Acids From Yeast. Four minor ribonucleotides have been isolated in relatively large amounts from those ribonucleic acids of yeast that are soluble in 1 M sodium chloride. ***Frank F. Davis, Angelo F. Carlucci, and Isaac F. Roubein.*** *Journal of Biological Chemistry*, v. 234, no. 6, June 1959, p. 1525-1529.

9929* Effect of Human Blood Serum on Tissue Cultures. II. Development of Resistance to Toxic Human Serum in Fibroblast-Like Cells (Earle's Strain L) Obtained From a C_3H Mouse. Resistance developed to toxic human serum was passed from one cell generation to another and was associated with a decrease in the ability of cells to adsorb toxic substances from the serum. Resistant cells differed from the sensitive cells in their morphological appearance, the increased frequency of minute chromosomes, and the increased adhesion to glass surfaces. ***S. Fedoroff and B. Cook.*** *Journal of Experimental Medicine*, v. 109, June 1959, p. 615-631 + 1 plate.

9930* Molecular Growth Requirements of Single Mammalian Cells. III. Quantitative Colonial Growth of Single S3 Cells in a Medium Containing Synthetic Small Mole-

cular Constituents and Two Purified Protein Fractions. ***Harold W. Fisher, Theodore T. Puck, and Gordon Sato.*** *Journal of Experimental Medicine*, v. 109, June 1959, p. 649-660 + 1 plate.

9931 Methods of Biochemical Analysis. v. VII. Eight reviews. ***David Glick, editor.*** 353 pp. 1959. Interscience Publishers, Inc., New York. (QP519 MS6 Vis.)

9932* Mutation Induction and Macromolecular Synthesis in Bacteria. The authors present evidence in support of the hypothesis that the principal mutagenic effect of ultraviolet light is to modify ribonucleic acid precursors present in the cell at the time of radiation exposure, that mutation is exerted through the process of incorporation of modified nucleic acid precursors with RNA synthesis resulting in modification of the RNA, and that RNA and protein synthesis are involved in replication of DNA, and changes in RNA specificity result in corresponding changes in genic DNA. ***C. O. Doudney and F. L. Haas.*** *National Academy of Sicences, Proceedings*, v. 45, May 1959, p. 709-722.

9933* Enzymatic Synthesis of Deoxyribonucleic Acid. VI. Influence of Bacteriophage T2 on the Synthetic Pathway in Host Cells. Extracts of *E. coli*, infected with bacteriophage T2, have been shown to contain three enzymes which are undetectable in extracts of uninfected, or in T5-infected, cells. These new enzymes can account for the availability of the triphosphate of hydroxymethyldeoxycytidine for the enzymatic synthesis of T2 DNA, the absence of deoxycytidylate from T2 DNA, and the presence of glucose on a fixed fraction of the hydroxymethylcytosine residues in DNA. ***Arthur Kornberg, Steven B. Zimmerman, S. R. Kornberg, and John Josse.*** *National Academy of Sciences, Proceedings*, v. 45, June 1959, p. 772-785.

9934* Chromosome Breakage Produced by Tritium-Labeled Thymidine in *Tradescantia paludosa*. The highest fragment frequency could be correlated with the period during which the maximum amount of H^3-thymidine was incorporated into the chromosomes. The mitotic index dropped sharply in roots that had been exposed to 1μc/ml of H^3-thymidine for periods over 8 hours. ***Donald E. Wimber.*** *National Academy of Sciences, Proceedings*, v. 45, June 1959, p. 839-846.

9935 Heterogeneity in Deoxyribonucleic Acids. I. Dependence on Composition of the Configurational Stability of Deoxyribonucleic Acids. II. Dependence of the Density of Deoxyribonucleic Acids on Guanine-Cytosine Content. Presents evidence that the two H-bonded base pairs (guanine-cytosine and adenine-thymine) contributed unequally to the stability of the helix, thereby causing the transition from the helical coil to a disordered coil to depend on the mean composition of either whole deoxyribonucleic acid molecules or large segments of it. A linear relation is found corresponding to a change of 0.00103 in density per 1.0% change in guanine–cytosine content. I. ***Julius Marmur and Paul Doty.*** II. ***Noboru Sueoko, Julius Marmur, and Paul Doty.*** *Nature*, v. 183, May 23, 1959, p. 1427-1431.

9936 Comparative Sensitivity to Radiation of Seeds From a Wild Plant Grown on Uraniferous and Non-Uraniferous Soils. At doses up to 100,000 *r*, *Andropogon filifolius* seeds originating from uraniferous soil exhibit a higher percentage of germination, and plantlets develop stalks and roots of greater average length. Enhancement of biological potentialities rather than degeneration has apparently resulted from long-continued low-level irradiation. ***D. J. Mewissen, J. Damblon, and Z. M. Bacq.*** *Nature*, v. 183, May 23, 1959, p. 1449.

9937* Skin Grafting in Insects. Skin grafts in insects have disclosed problems of incompatibility unknown in vertebrates. Experiments with the bug *Rhodnius* are described. ***Michael Locke.*** *New Scientist*, v. 5, June 18, 1959, p. 1337-1339.

9938* Highlights of the Chemistry of the Newer Antibiotics. ***R. E. Harman.*** *New York Academy of Sciences, Transactions*, v. 21, no. 6, Apr. 1959, p. 469-483.

9939* On the Nature of Cancer. Presents evidence suggesting that insulin is an important regulator of growth of normal cells, but not of cancer cells. ***Samuel Graff.*** *New York Academy of Sciences, Transactions*, v. 21, no. 6, Apr. 1959, p. 505-517.

9940* A Study of Comparative Protection Against Lethality of Triethylenemelamine, Nitrogen Mustard, and X-Irradiation in Mice. Suggests that the mechanism of cysteine protection is through direct chemical inactivation of HN2. ***Edwin I. Goldenthal, M. V. Nadkarni, and Paul K. Smith.*** *Radiation Research*, v. 10, no. 5, May 1959, p. 571-583.

9941* The Effects of Ultraviolet Light on Some Components of the Nucleic Acids. III. Apurinic Acid. Apurinic acid, prepared from deoxyribonucleic acid, is destroyed by ultraviolet light much more rapidly than would be expected from the behavior of the component pyrimidine-nucleotides under this radiation. Both thymine and cytosine are sensitive. It seems likely that the purines in deoxyribonucleic acid protect the pyrimidines to a certain extent against the U.V. radiation and the sensitivity of deoxyribonucleic acid to U.V. radiation is caused by the pyrimidines present as constituent parts of the molecule. The primary action of this radiation on living cells may be caused by destruction of the pyrimidines in the nucleic acids. ***R. Beukers, J. Ijlstra, and W. Berends.*** *Recueil des Travaux Chimiques des Pays-Bas*, v. 78, Mar. 1959, p. 247-251.

9942 Biophysical Science. A Study Program. Compact summaries of certain key problems and critical evaluations of recent advances in these areas. Subjects discussed included: molecular biology, cellular dynamics and responses, molecular configuration of synthetic and biological polymers, physicochemical characterization of macromolecules, the hydrogen bond, macromolecular systems, biochemical synthesis, mechanisms of enzyme action, molecular structure and biosynthesis of nucleic acids, genetics and the role of nucleic acids, genetic fine-structure analysis, and coding aspects of protein synthesis. ***J. L. Oncley, et al.*** *Reviews of Modern Physics*, v. 31, no. 1, Jan. 1959, 268 pp.

9943 Biophysical Science. A Study Program. The second part of this series of papers, outlining the present status of biophysical research and discussing future problems. Papers in this part review: radiation inactivation of enzymes, nucleic acids, and phage particles; fine structure of cell nucleus, chromosomes, nucleoli, membrane, and cytoplasm; the organization of membranous layers, and biological lamellar systems; membrane transport; interaction properties of elongate protein macromolecules; molecular biology of mineralized tissues; structure of muscle cells; motility of cilia and the mechanism of mitosis; mechanisms of muscle contraction; interactions between cells; molecular organization of the nerve fiber; nature of the nerve impulse; biological transducers and coding; mechanisms of synaptic transmission; chemical specificity in biological systems; and hormone regulation. ***J. L. Oncley, editor.*** *Reviews of Modern Physics*, v. 31, no. 2, Apr. 1959, p. 269-568.

9944 Antibiotics. Historical review of the growth of antibiotics research and development, and a general survey of antibiotic structure. ***Paul R. Burkholder.*** *Science*, v. 129, May 29, 1959, p. 1457-1465.

9945 Biochemical Theories of Schizophrenia. Part II of a two-part critical review of current theories and of the evidence used to support them. ***Seymour S. Kety.*** *Science*, v. 129, June 12, 1959, p. 1590-1596.

9946 Immunological Specificity: Unique Combinations of Selected Natural Globulins Provide an Alternative to the Classical Concept. The concept of immunological specificity, based on a unique combination of natural globulins, is an attractive alternative to the classical concept of unique globulin molecules for each possible antigen. Many hitherto separate facets of the antibody response, such as antibody diversity, cross-reactions, may be related through the general thesis that antibody production is not a unique biological phenomenon, but a highly specialized example of certain general cellular processes. ***David W. Talmage.*** *Science*, v. 129, June 19, 1959, p. 1643-1648.

9947 Genes and Antibodies. Discussed are antibody globulin, gene for globulin synthesis, genic diversity of precursor cells, hypermutability, spontaneous production of antibody, induction of immune tolerance, excitation of massive antibody formation, proliferation of mature cells, persistence of clones. ***Joshua Lederberg.*** *Sicence*, v. 129, June 19, 1959, p. 1649-1653.

9948 A Case History in Biological Research. Discussed are work with *Neurospora*, basic concepts, biochemical mutants, microbial genetics, and antibiotics and mammalian cells. ***Edward L. Tatum.*** *Science*, v. 129, June 26, 1959, p. 1711-1715.

9949 Genes and Chemical Reactions in Neurospora. ***George W. Beadle.*** *Science*, v. 129, June 26, 1959, p. 1715-1719.

9950 The Interpretive Cortex. The interpretive cortex has in it a mechanism for instant reactivation of the detailed record of the past. Access to the record of the past seems to be as readily available from the temporal cortex of one side as from that of the other. Auditory illusions (or interpretations of the distance, loudness, or tempo of sounds) have been produced by stimulation of the temporal cortex of either side. But, on the contrary, visual illusions are only produced by stimulation of the temporal cortex on the nondominant (normally, right) side of the brain. ***Wilder Penfield.*** *Science*, v. 129, June 26, 1959, p. 1719-1725.

9951* Preparation and Anti-Insulin Activity of Lipoprotein Fractions From Rat Serum. ***M. E. Krahl, M. E. Tidball, and E. Bregman.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 101, no. 1, May 1959, p. 1-6.

9952* Repopulation of Hematopoietic Tissues of X-Irradiated Mice by Cells From Leukemoid Blood. ***Ruth M. Merwin.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 101, no. 1, May 1959, p. 9-12.

9953* Immunization Against Ehrlich's Ascites Carcinoma With X-Irradiated Tumor Cells. Pre-immunization with irradiated Ehrlich's ascites tumor cells protected mice against subsequent intraperitoneal transplants of viable cells. Immunization procedures started one day after subcutaneous challenge with the tumor, significantly reduced mortality. ***David M. Donaldson and John R. Mitchell.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 101, no. 2, June 1959, p. 204-207.

9954* Stimulation of Mitosis in Rat Marrow Cultures by Serum From Infected Rats. Serum from acutely infected rats produced a 2- to 3-fold increase in the mitotic index of rat marrow cells in short-term tissue cultures. ***Peter C. Nowell.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 101, no. 2, June 1959, p. 347-350.

9955 A Symposium on the Chemical Basis of Development. Papers from the symposium held at Johns Hopkins University in March, 1958, covering developmental cytology, cellular and tissue interactions in development, problems of specificity in growth and development, and control mechanisms in development. ***William D. McElroy and Bentley Glass, editors.*** 934 pp. 1958. The Johns Hopkins Press, Baltimore, Md.

9956 The Photochemical Apparatus. Its Structure and Function. The papers in this volume were presented at the Brookhaven Symposium in Biology held in June, 1958. Papers examine the process of photosynthesis from the point of view of cellular and intracellular structure, and the biochemical and physical chemical functions of these structures. *U. S. Atomic Energy Commission, BNL*-512(C28), Apr. 1959, 366 pp. (UF767 Un3.1bn Contin.)

9957* Detection of Antigenically Distinctive Components of Mouse Melanoma S91. The S91 melanoma and normal tissues of the host mouse strain possess distinctive antigenic components. In preliminary tests of a tumor of more recent origin, the B16 melanoma, similar antigenic differences between the neoplasm and tissues of its C57BL/6 host strain were observed. ***Peter Abramoff, Harry Chinchinian, and John W. Saunders, Jr.*** *U. S. National Cancer Institute, Journal*, v. 22, no. 5, May 1959, p. 919-925.

9958* The Synthesis of Deoxyribonucleic Acid by HeLa Cells Infected With Vaccinia Virus. There was an increased utilization of thymidine-2-C^{14} by infected cells with the concomitant appearance of an alteration in the acid stability of the cellular DNA. ***W. E. Magee and B. P. Sagik.*** *Virology*, v. 8, no. 1, May 1959, p. 134-137.

9959* A Plant Virus Lethal to Its Insect Vector. Analysis of the maximum longevity figures for transmitting and nontransmitting leafhoppers indicates that the virus shortens the life of the insect, also. Western X-disease virus appears to provide an example of a virus which has not yet evolved to the point that it has ceased to injure its insect vector. ***D. D. Jensen.*** *Virology*, v. 8, no. 2, June 1959, p. 164-175.

9960* The Mutagenic and Inactivating Effect of Nitrous Acid on Free Particles of the Phage T2. T2 phages are inactivated by *in vitro* treatment with nitrous acid at pH 4.5. The inactivation follows first-order kinetics with respect to the time of treatment. During the treatment, a significant rise in plaque-type mutants m, tu, and r, was observed. A detailed analysis of the r mutants revealed a linear increase with respect to the log of inactivation and the time of treatment. Control experiments demonstrate that inactivation and mutation are due to the action of nitrous acid, and not to effects produced by the salt concentration or the pH of the incubation mixture. (*In German.*) Mutagene und inaktivierende Wirkung salpetriger Säure auf freie Partikel des Phagen T2. ***W. Vielmetter and C. M. Wieder.*** *Zeitschrift für Naturforschung*, v. 14b, May 1959, p. 312-317 + 2 plates.

9961* The Kinetics of Inactivation and Reactivation of Phages. III. Report: A Hit-Theory Analysis of the Course of Inactivation of Phages by Formaldehyde. (*In German.*) Über die Kinetik der Inaktivierung und Reaktivierung von Phagen. ***K. Heicken and G. Spicher.*** *Zeitschrift für Naturforschung*, v. 14b, May 1959, p. 318-323.

See also: **9893** (mineral oil overlay of plant tissue culture); **10417** (radio telemetering from within human body).

CERAMICS AND CONCRETE

9962 Thermal Shock Resistance. A Design Parameter for Ceramic Radome Walls. Experimental data on several radome ceramics for thermal stresses both perpendicular and parallel to the radome wall. Data for high purity alumina and fused silica. Use of molten salt bath for test medium. Desirability of a low thermal expansivity. ***E. J. Luoma and E. B. Shand.*** *Aero/Space Engineering*, v. 18, June 1959, p. 43-47.

9963 Effect of Lime on Characteristics of Mortar in Masonry Construction. Describes tests which were carried out with the object of developing a better understanding of the performance characteristics of brick masonry construction which have been observed in the field and for the further purpose of setting up convenient laboratory tests which could serve for evaluation of various mortar materials with brick of widely different characteristics. The presence of lime is found to be beneficial in developing less leakage, tighter bond, less efflorescence, and high mortar-brick assemblage strength. ***L. John Minnick.*** *American Ceramic Society, Bulletin*, v. 38, May 1959, p. 239-245.

9964 The Role of Organic Matter in Slip Casting. The main source of naturally occurring organic matter is ball clay. A breakdown product of lignin called humic acid governs the effect of organic matter appearing in ball clay. The amount of humic acid in casting slips varies with the previous history of the ball clay. Assessment of sanitaryware body casting qualities and the nature of their ball clay components led to the conclusion that a balance between organic colloid and a flocculating element governs slip properties. ***G. W. Phelps.*** *American Ceramic Society, Bulletin*, v. 38, May 1959, p. 246-250.

9965 Comparison Between Al_2O_3-Ta and Al_2O_3-W Reactions Above 1600 C in a Vacuum. ***Louis Navias.*** *American Ceramic Society, Bulletin*, v. 38, May 1959, p. 256-259.

9966 Formation of $BaTiO_3$ From $BaCO_3$ and TiO_2 in Air and in CO_2. A small amount of $BaTiO_3$ is formed first directly from $BaCO_3$ and TiO_2 at the surface of contact. From then on it is a diffusion-controlled reaction, and both $BaTiO_3$ and Ba_2TiO_4 are produced, with Ba_2TiO_4 being formed in much

larger amounts. In 1 atm. of CO_2, the intermediate Ba_2TiO_4 was suppressed up to a temperature of about 1100 C in agreement with thermodynamic calculations. Ba_2TiO_4 reacts fast with 1 atm. of CO_2 below about 1100 C to produce $BaTiO_3$ and $BaCO_3$. ***Lieselotte K. Templeton and Joseph A. Pask.*** *American Ceramic Society, Journal,* v. 42, May 1959, p. 212-216.

9967 Studies in Lithium Oxide Systems: V. Li_2O-$Li_2O \cdot B_2O_3$. Nine compositions containing 40 to 68% B_2O_3 were used to study the high-lithia portion of the system Li_2O-B_2O_3 by quenching and differential thermal analysis methods. X-ray diffraction data for the compounds are tabulated, and the complete phase diagram for the system Li_2O-B_2O_3 is presented. ***B. S. R. Sastry and F. A. Hummel.*** *American Ceramic Society, Journal,* v. 42, May 1959, p. 216-218.

9968 Sintering of High-Purity Nickel Oxide. II. The effects of particle size, compacting pressure, additives, and mode of preparation on the sintering of nickel oxide are presented. A low calcining temperature results in a high bulk density of a sintered compact. No appreciable change in the rate of sintering is found above 1000 kg. per sq. cm., whereas the unheated density increases with increasing pressures. Additions of CaO promote sintering, additions of Na_2O, Fe_2O_3, and Al_2O_3 retard sintering, and CeO_2 and Ag_2O have no effect; B_2O_3 accelerates grain growth but retards densification. Nickel oxide from oxalate has a small rate of sintering as compared with nickel oxides from hydroxide, nitrate, and carbonate. ***Yoshio Iida and Shunro Ozaki.*** *American Ceramic Society, Journal,* v. 42, May 1959, p. 219-228.

9969 Wetting of Original and Metallized High-Alumina Surfaces by Molten Brazing Solders. An apparatus using the sessile-drop method is described for determining surface tension and wettability data of liquid-solid systems at elevated temperatures in vacuum and in controlled atmospheres. The relative merits of some of the current methods of metallizing alumina ceramics are evaluated in terms of solder wetting. The wetting by molten brazing metals and alloys is reported as a function of time in terms of contact angle on surfaces of high-alumina ceramics with and without various types of high-temperature metal coatings. ***J. C. Williams and J. W. Nielsen.*** *American Ceramic Society, Journal,* v. 42, May 1959, p. 229-235.

9970 Variations of Surface Tension With Body and Surface Concentrations. Mathematical derivatives of surface tension with body concentration and with surface concentration are examined analytically for solutions in which the activity coefficient of the solute is taken as a linear function of solute concentration in the body, and as fixed at unity in the surface. ***A. B. Bestul.*** *American Ceramic Society, Journal,* v. 42, May 1959, p. 236-241.

9971 The Glassmelting Process: II. Glass Structure and the Effects of "Melting History" on Glass Properties. The existence of effects determined by the "melting history" of a glass is demonstrated by specially programmed experiments on viscosity and tensile strength. The viscosity curve of glass melted at a relatively low temperature lies above that for the same glass which had been previously melted at high temperatures. The two curves merge in the high-temperature region. It also is found that the tensile strength of glass fibers increases as the maximum melting temperature increases. ***Charles L. McKinnis and John W. Sutton.*** *American Ceramic Society, Journal,* v. 42, May 1959, p. 250-253.

9972 Young's Modulus of Various Refractory Materials as a Function of Temperature. Determinations by a dynamic method for single-crystal sapphire and ruby and for polycrystalline Al_2O_3, MgO, ThO_2, mullite, spinel, stabilized ZrO_2, SiC, and Ni-bonded TiC. ***J. B. Wachtman, Jr. and D. G. Lam, Jr.*** *American Ceramic Society, Journal,* v. 42, May 1959, p. 254-260.

9973 Note on Relation Between Unfired and Fired Densities of Aluminum Oxide Compacts. ***Nazzareno Viola and Malcolm McQuarrie.*** *American Ceramic Society, Journal,* v. 42, May 1959, p. 261-262.

9974* Fatigue Study of Air-Entrained Concrete. Fatigue tests were performed on two types of concrete, each proportioned for the same 28-day compressive strength; one contained only "accidental" air, while the other contained intentionally entrained air which was maintained at a constant level. There was little variation in the ages of the specimens which were tested at stress levels of 50, 60, 70, 80, and 90% of the ultimate static compressive strength of the respective mixes. ***John De C. Antrim and John F. McLaughlin.*** *American Concrete Institute, Journal,* v. 30; *ACI Proceedings,* v. 55, no. 11, May 1959, p. 1173-1182.

9975* Flexural and Compressive Strength of Concrete as Affected by the Properties of Coarse Aggregates. Depending on the aggregate, differences of 40% in flexural strength and 29% in compressive strength were obtained for concrete of the same mix proportions. Statistical analysis indicated that the shape, surface texture, and modulus of elasticity of the aggregates were the main causes of variation in concrete strength. ***M. F. Kaplan.*** *American Concrete Institute, Journal,* v. 30, *ACI Proceedings,* v. 55, no. 11, May 1959, p. 1193-1208.

9976* Internal Shielding Construction at Shippingport Nuclear Power Plant. Concrete walls 4 to 6 ft. thick, constructed inside 50-ft. diameter steel chambers at the Shippingport, Pa., atomic power plant, serve as shielding against radioactivity. Describes unusual construction practices occasioned by limited access to chamber interiors. Concrete was a standard density, 3000-psi mix made with Type 1S cement. ***L. Earl Tabler, Jr.*** *American Concrete Institute, Journal,* v. 30, *ACI Proceedings,* v. 55, no. 13, May 1959, p. 1209-1214.

9977 Fabrication of Ceramic Fuel Elements by Swaging. Ceramic fuel materials can be simultaneously compacted and clad by swaging to form relatively inexpensive fuel elements. The feasibility of manufacturing ceramic fuel elements by the swaging process will depend principally upon the densities obtainable, the reproducibility of the product, and the irradiation behavior of the fuel assembly. ***D. R. Stenquist and R. J. Anicetti.*** Paper from "Nuclear Metallurgy. v. V. Ceramic Base Elements; Metal Base Fuels and Jacket Components", *American Institute of Mining, Metallurgical and Petroleum Engineers,* New York. 1958. p. 1-12. (TN697 Am35n5)

9978 Fabrication of Aluminum Plate-Type Elements Containing Uranium Dioxide as the Fuel. A method is described for the fabrication of plate-type fuel elements in which the fuel is a dispersion of UO_2 in an Al matrix. Advantages of the method as compared to use of a cast alloy are discussed: 1) U as an oxide is purer than the metallic form; 2) Reduction to metal is avoided; 3) Less scrap is formed in the processing of fuel plates; 4) Fewer steps are required for preparation of plates; 5) UO_2 can easily be recovered for recycling if necessary; 6) Burnable poisons can be added accurately and uniformly; 7) Concentration gradients in fuel content can be used. The following properties of the fuel plate are also discussed: 1) Uniformity of fuel distribution; 2) dimensional tolerances on core and clad; 3) end effects; and 4) integrity of bonding. ***S. I. Megeff and J. L. Zambrow.*** Paper from "Nuclear Metallurgy. v. V. Ceramic Base Elements; Metal Base Fuels and Jacket Components", *American Institute of Mining, Metallurgical and Petroleum Engineers,* New York. 1958, p. 25-28. (TN697 Am35n5)

9979* Some Equipment for Ceramic Research. Equipment for investigation of reactions and physical properties of ceramic materials is described. Details of several types of high-temperature furnaces and of apparatus for determination of the creep of ceramics under compressive and transverse-bending stresses are included. To illustrate the use of the equipment, approximate liquidus diagrams for the Gd_2O_3-Al_2O_3 and Sm_2O_3-Al_2O_3 systems are presented together with the results of the creep under compression of a range of firebricks and of the creep in transverse bending of a zircon-chromic oxide composition. ***F. H. Aldred and A. E. S. White.*** *British Ceramic Society, Transactions,* v. 58, Apr. 1959, p. 199-223.

9980 Production and Some Properties of Silicon Nitride Ceramics. ***I. S. Brokhin and V. F. Funke.*** *Henry Brutcher Translation No.* 4490, 10 pp. (From *Ogneupory,* v. 22, no. 12, 1957, p. 562-566.) Henry Brutcher, Altadena, Calif.

9981 Impregnation of Silicon-Carbide Articles With Metals. Gas-phase impregnation of silicon carbide articles with metals selected on the basis of the difference between their boiling point and the temperature of the active state of silicon carbide. Details on electric furnace used. Methods of packing

the impregnating materials. Best composition of impregnating mix for ease of molding and performance. Properties of silicon-impregnated silicon carbide; properties of various German and American silicon-carbide heating elements. Chief advantages of new process: workpieces may be air-dry and need not be recrystallized. ***A. N. Novikov.*** *Henry Brutcher Translation No.* 4504, 16 pp. (From *Ogneupory*, no. 12, Dec. 1957, p. 557-562.) Henry Brutcher, Altadena, Calif.

9982 How to Drill Small Holes in Hard Ceramic Parts. Ultrasonic technique for drilling four accurately-spaced straight 0.015-in. diameter holes through the side of a core of a very hard and brittle vitrified ferrite compound which has drilling and machining characteristics similar to glass. ***N. K. Marshall.*** *Ceramic Industry*, v. 72, May 1959, p. 103 + 2 pages.

9983 On the Influence of Pre-Treatment and Transition Processes on the Adsorption Capacity and the Reactivity of Various Types of Glass and Silica. Influence of cooling atmospheres, particularly in the transition interval, on the adsorption activity and liability of attack of glass vessels that were pre-treated or stored in various gas atmospheres, and of the changes in the glass surface on contact with oxidic materials, contacts that often occur in modern constructions relating to buildings or industrial equipment. ***J. Arvid Hedvall.*** *Chalmers Tekniska Högskolas Handlingar*, no. 207, 1959, 39 pp. (T4 C35t Contin.)

9984 Pilot Plant Production, Synthetic Quartz. Hydrothermal production of synthetic quartz. ***R. A. Laudise and R. A. Sullivan.*** *Chemical Engineering Progress*, v. 55, May 1959, p. 55-59.

9985* Fine Crushing and Air Separation. Fine-crushing and air-separating equipment principles, construction, working methods, and results. (*In German.*) Feinzerkleinerung und Windsichtung. ***Walter Beushausen.*** *Chemische Technik*, v. 11, no. 4, Apr. 1959, p. 190-200.

9986* High Temperature Inorganic Reactions. The use of differential thermal analysis, thermogravimetric analysis, X-ray diffraction procedures, and phase-equilibrium studies in the investigation of inorganic chemical reactions occurring at temperatures up to 2000 C is discussed. The information to be gained from each type of technique and the limitations to which each is subject are considered. ***Norman F. H. Bright.*** *Chemistry in Canada*, v. 11, May 1959, p. 30 + 4 pages.

9987* The Sintering of Corundum. A new method is described for the continuous measurement of the degree of sintering of a body in furnace. The instantaneous density of a specimen is determined by the continuous absorption of γ-rays from a suitable source and by the dilatometric effect. (*In German.*) Das Sintern von Korund. ***H. Britsch.*** *Deutsche Keramischen Gesellschaft, Berichte*, v. 36, May 1959, p. 133-145.

9988 Silicon Carbide Heating Elements and Their Application. I. Characteristics of Si carbide heating elements, their means of calibration and methods for positioning the elements in different types of installations are covered. ***Edward Macer.*** *Industrial Heating*, v. 26, May 1959, p. 896 + 6 pages.

9989* Fabrication of Ceramic Shapes. New process uses a flame-spraying technique for building up a continuous coating on a metal mandrel having the desired shape and size of the finished ceramic piece. The mandrel is not destroyed and can be re-used many times to produce duplicate shapes. ***H. C. Wagner.*** *Missile Design and Development*, v. 5, May 1959, p. 32 + 2 pages.

9990 The Future of Ceramics as Nuclear Fuel. I. What Are Ceramics? II. Development of the New Fuels. An introduction to ceramics in general, and the data now available on the materials being developed to replace metallic fuels. I. ***N. C. Moore and J. B. Huffadine.*** II. ***Peter Murray.*** *Nuclear Power*, v. 4, May 1959, p. 86-94.

9991* Capillary Continuity or Discontinuity in Cement Pastes. Study of the capillary structure of cement paste in terms of data on permeability to water. Capillaries in fresh paste are continuous, but if the specific surface area of the cement is 1800 cm^2/g or greater, and if the water-cement ratio is not higher than 0.7 by weight, production of cement gel during the curing period will eventually segment the capillaries, forming "capillary cavities". Practical consequences are discussed. ***T. C. Powers, L. E. Copeland, and H. M. Mann.*** *Portland Cement Association, Journal of the Research and Development Laboratories*, v. 1, no. 2, May 1959, p. 38-48.

9992* The High-Temperature Properties of Ceramics and Cermets. Evaluation of the major properties involved, viz., creep strength, fatigue strength, resistance to thermal fatigue (i.e. to repeated thermal shocks), oxidation-resistance, and impact-resistance. The materials evaluated include oxides, oxide-metal cermets, carbides, carbide-metal cermets, Mo disilicide, and Si nitride. ***E. Glenny and T. A. Taylor.*** *Powder Metallurgy*, nos. 1/2, 1958, p. 189-226.

9993* The Fabrication and Properties of Chromium-Alumina and Molybdenum-Chromium-Alumina Cermets. J. B. Huffadine, L. Longland, and N. C. Moore. *Powder Metallurgy*, nos. 1/2, 1958, p. 235-252.

9994* Processes Involved in Sintering. René G. Bernard. *Powder Metallurgy*, no. 3, 1959, p. 86-103.

9995* The Mechanism of Sintering in Single-Component Systems. I. M. Fedorchenko and R. A. Andrievsky. *Powder Metallurgy*, no. 3, 1959, p. 147-171.

9996 Cooperative Magnetism in Oxide Structures. I. Antiferromagnetism and Ferromagnetism. Some introductory remarks on the fundamentals of magnetism are followed by a discussion of the antiferromagnetic and ferromagnetic properties of certain oxide systems. A brief account is given of the current theories of indirect magnetic exchange interaction. (To be continued.) ***L. C. F. Blackman.*** *Research*, v. 12, May 1959, p. 164-171.

9997 Surface Tension and Density Measurements on Molten Glasses in the $CaO \cdot Al_2O_3 \cdot SiO_2$ System. Measurements using a modification of the maximum bubble pressure method are described. Statistical analysis of the results leads to the postulation of a series of general relationships between composition and density or surface tension, and their temperature coefficients. In the light of these relationships a model for the structure of molten silicates is discusssed. ***L. R. Barrett and A. G. Thomas.*** *Society of Glass Technology, Journal*, v. 43, Apr. 1959, p. 179T-190T.

9998* Wear Measurements by Radioactive Isotopes Applied to Blast Furnace Linings. Methods of measurement. Disposition of the radioactive Co-60 isotopes in the brickwork. Practice and evaluation of radiation measurements. Course of the wear of brickwork. (*In German.*) Verschleissmessungen mit radioaktiven Isotopen an Hochofenausmauerungen. ***Alexander Schepers and Franz-Rudolf Licht.*** *Stahl und Eisen*, v. 79, no. 10, May 14, 1959, p. 669-674.

9999* Investigations on Basic Steel Converter Bottoms. Practice of the new dolomite plant. Vibrating converter bottoms by means of a plate vibrated from above. Composition of crude and calcined converter bottoms. Form of the carbon in the calcined bottom. Operating conditions of the converter and their influence upon the bottom life. Influence of the compression between bottom and lining. Effect of blowing on the bottom life. Relationship between the quality of the steel and bottom wear. Economic efficiency of the operation. (*In German.*) Untersuchungen an Böden von Thomaskonvertern. ***Werner Köhler, Theodor Hartmann, and Gerhard Trömel.*** *Stahl und Eisen*, v. 79, no. 10, May 14, 1959, p. 674-683.

10000 Thermal Properties of Ceramics. Melting and safe operating temperatures; thermal conductivity; thermal expansion; thermal endurance of dense ceramics; thermal conditioning treatments. ***Edward J. Smoke and John H. Koenig.*** 53 pp. Jan. 1958. College of Engineering, Rutgers University, New Brunswick, New Jersey. (TP815 R93.2e)

10001 Effects of Irradiation on Stainless Steel-Clad UO_2 Pellets in Helium or Carbon Dioxide. Uranium dioxide pellets sealed in Type 316 stainless steel containers with a He gas were irradiated in He and in CO_2 in thermal fluxes of the order of 1×10^{13} $n/(cm^2)$ (sec). Cladding-surface tempeartures were reportedly between 1200 and about 1800 F. ***Gerald E. Lamale, John E. Gates, and Ronald F. Dickerson.*** *U. S. Atomic*

Energy Commission, BMI-1335, Apr. 21, 1959, 16 pp. (UF767 U3b Contin.)

10002 An Evaluation of Hydroclones for Size Classification of Thorium Oxide. Oversize material was removed from 1-3 μ mean diameter ThO_2 by use of commercial (modified TM-3 Dorr Clones) equipment. Batch and continuous classification were demonstrated with product rates of up to 1 kg of ThO_2 per minute and removal of over 95% of material three times the mean diameter. Dispersion was not complete even with dispersing agents; therefore, effective removal of undersize ThO_2 was not practical. ***E. L. Youngblood and P. A. Hass.*** *U. S. Atomic Energy Commisison, ORNL-2689*, May 18, 1959, 45 pp. (UF767 U3o Contin.)

See also: **10121** (silicate analysis); **10720** (properties of Ferroxdure); **10887** (glass radiation-shielding windows for hot cells).

CHEMICAL ENGINEERING

10003 Water Treatment. Facts and Procedures. Water treatment essentials and specifying the water treatment. ***Olivia P. Burkey and W. L. Andrews.*** *ASHRAE Journal*, v. 1, May 1959, p. 56 + 6 pages.

10004* Emulsification of Herbicides. Discussion of the parameters directly concerned with the making of a quality herbicide formulation. ***J. W. Van Valkenburg and J. A. Kelly.*** *Agricultural Chemicals*, v. 14, May 1959, p. 38 + 3 pages.

10005* Measurement of Flow of Phosphoric Acid and Nitrogen Solutions. ***W. E. Jones.*** *Agricultural Chemicals*, v. 14, May 1959, p. 47.

10006* A Valve Maintenance Program for Gas Distribution Systems. Programmed lubrication saves valves, assures "trouble free" operation. ***Clifton R. Newlin.*** *American Gas Journal*, v. 186, May 1959, p. 47-49.

10007* Hi-Btu Gases From Fluid Fuels. Present and Future Methods. V. Continuous Pressure Hydrogasification. ***Henry R. Linden and Martin A. Elliott.*** *American Gas Journal*, v. 186, May 1959, p. 50-56.

10008* Dust in Gas Streams. III-B. Recommendations for Sampling. Recommended sampling methods and techniques are summarized. ***Arnold W. Doyle, Norman M. Wiederhorn, and Arthur Swan.*** *American Gas Journal*, v. 186, May 1959, p. 57-59.

10009* Plug Valve Regulators: Application and Operation. Plug valve can assume new role as pressure-control device. ***Howard J. Evans.*** *American Gas Journal*, v. 186, May 1959, p. 64 + 1 page.

10010 Heat Transfer and Fluid Dynamics in Mercury-Water Spray Columns. ***R. D. Pierce, O. E. Dwyer, and J. J. Martin.*** *A.I.Ch.E. Journal*, v. 5, no. 2, June 1959, p. 257-262.

10011 Transporting Dry Chemicals. New equipment is listed. ***Gerrit W. Van Schaick.*** *American Paint Journal*, v. 43, May 11, 1959, p. 92 + 2 pages.

10012* Internal Boiler Water Treatment—A New Development. Controlled introduction of chemicals into boiler water so that the boiler acts as a hot softening plant. ***C. Hinchcliffe.*** *Australasian Engineer*, 1959, Apr. 7, p. 57-60.

10013* A Theoretical Analysis of Thermal Surface Fouling. A new approach to fouling offers the possibility of a more rational method of heat-exchanger design. ***D. Q. Kern and R. E. Seaton.*** *British Chemical Engineering*, v. 4, May 1959, p. 258-262.

10014* New Selective Sorbents: Porous Crystals as Molecular Filters. The structure and action of new selective sorbents are reviewed and possibilities are indicated for their large-scale use. ***R. M. Barrer.*** *British Chemical Engineering*, v. 4, May 1959, p. 267-279.

10015* Liquid Flow Through an Annulus. Nomogram. ***D. Wormald.*** *British Chemical Engineering*, v. 4, May 1959, p. 290 + 1 page.

10016 Boiler Feedwater Treatment. Gives simple rules for the choice of feedwater treatment including consideration of the degree of steam purity needed and of the changes in composition produced by softening treatment and, from these, to choose a water of the required silica and dissolved solids content to fit the particular boiler plant. ***P. Hamer.*** *British Paper and Board Makers' Association (Inc.), Proceedings of the Technical Section*, v. 40, pt. 1, Feb. 1959, p. 71-86. (TS1080 P19p Vis.)

10017 Bubble-Tray Design Manual. Prediction of Fractionation Efficiency. 94 pp. 1958. American Institute of Chemical Engineers, New York. (TP159.P6 Am35.6b)

10018 Low Pressure Hydrogenation of Coker Distillate From Athabasca Bitumen. The rate of decline of cobalt molybdate-alumina catalyst activity due to coke deposition was studied. ***F. L. Booth, R. E. Carson, K. W. Bowles, and D. S. Montgomery.*** *Canada, Mines Branch, Research Report*, R-30, Sept. 5, 1958, 92 pp. (TN26 C16.5r Contin.)

10019 Sodium Hydroxide-Sodium Sulphate Stripping of Uranium From Amine Extracts. ***A. I. Bellingham and R. Simard.*** *Canadian Journal of Chemical Engineering*, v. 37, no. 3, June 1959, p. 113-116.

10020* W.P.R.B.'s Tests With New-Type Detergent 'Very Encouraging'. Review of Water Pollution Research Board's research of interest to industry. *Chemical Age*, v. 81, May 9, 1959, p. 779.

10021 Make Dialysis Part of Your Unit Operations. New acid-resistant membranes. ***N. S. Chamberlin and B. H. Vromen.*** *Chemical Engineering*, v. 66, May 4, 1959, p. 117-122.

10022 Estimate Specific Liquid Volumes. Chart for estimating specific liquid molal volumes over an extended range of temperature and pressure. ***Benjamin C.-Y. Lu.*** *Chemical Engineering*, v. 66, May 4, 1959, p. 137-138.

10023 Better (Not Less) Water Cooling. New thinking on water as coolant can lower costs and improve operations. *Chemical Engineering*, v. 66, May 4, 1959, p. 145-146.

10024 Two-Stage Cat Cracking Proves Out. As demand for gasoline octanes and yields rises, two-stage cracking promises more profits. *Chemical Engineering*, v. 66, June 1, 1959, p. 46 + 1 page.

10025 Integrated Kiln Leads Refinery Update. New integrated predryer-kiln-cooler brings major gains in modernization of sugar refinery. *Chemical Engineering*, v. 66, June 1, 1959, p. 50 + 2 pages.

10026 Treated Concrete Resists Acid Attack. New SiF_4 treatment eliminates free lime to cut concrete's vulnerability to corrosive attack. *Chemical Engineering*, v. 66, June 15, 1959, p. 84 + 1 page.

10027 Plate-Type Heat Exchangers. The exchanger consists of a pack of standard plates that act as heat-transfer surfaces. ***F. J. Lawry.*** *Chemical Engineering*, v. 66, June 29, 1959, p. 89-94.

10028 How to Calculate and Combat Static Electricity Hazards in Process Plants. II. ***D. I. Saletan.*** *Chemical Engineering*, v. 66, June 29, 1959, p. 101-106.

10029 Chemical Engineering Group, Proceedings. 1956-1957. A series of 20 chemical engineering studies reprinted from *Chemistry and Industry*. Includes a symposium on safety. Chemical Engineering Group, Proceedings. v. XXXVIII. Sections individually paged. 1959. Chemical Engineering Group, London. (TP1 So13p Vis.)

10030 Continuous Monitoring of Hydrocarbon Contaminants in Low Temperature Air Separation Plants. ***G. S. Cochrane and E. J. Rosenbaum.*** *Chemical Engineering Progress*, v. 55, Feb. 1959, p. 54-58.

10031 Foam Fractionation: Metals. According to results of this study, the most important factor in determining the success of a particular application of metals separation by foaming seems to be the proper choice of foaming-complexing agent. ***Robert W. Schnepf, Elmer L. Gaden, Jr., Ella Y. Mirocznik, and Ernesto Schonfeld.*** *Chemical Engineering Progress,* v. 55, May 1959, p. 42 + 4 pages.

10032 Solids Recovery by Crystallization. A process which, in many cases, is the only way to obtain high-purity materials from impure solutions. ***Hans Svanoe.*** *Chemical Engineering Progress,* v. 55, May 1959, p. 47-54.

10033 Demisters for Sulfuric Acid Plant Stacks. A case history shows that wire mesh filters are efficient in control of sulfuric acid plant stack gas. ***O. D. Massey.*** *Chemical Engineering Progress,* v. 55, May 1959, p. 114 + 3 pages.

10034* The Frequency Response of Some Illustrative Models of Porous Media. Experiments and computations with two artificial packed beds to illustrate a method of determining parameters of the bed. ***G. A. Turner.*** *Chemical Engineering Science,* v. 10, nos. 1/2, Apr. 1959, p. 14-21.

10035* On Heat Transfer Between Vapour Bubbles in Motion and the Boiling Liquid From Which They Are Generated. Discussion of the mechanism of heat transfer between a boiling liquid and vapor bubbles in motion. Fritz' and Ende's experimental results regarding this problem are interpreted. ***E. Ruckenstein.*** *Chemical Engineering Science,* v. 10, nos. 1/2, Apr. 1959, p. 22-30.

10036* Absorption of Iodine Vapour by Aqueous Solutions. Absorption of vapor into several aqueous absorbents has been studied using a disc-type laboratory column. The absorption rate was found to be completely gas-phase controlled, under all conditions investigated, for absorbents containing the Na salts of thiosulphate, hydroxide, or iodide. With water, sodium tetrathionate and sodium sulphate solutions, appreciable liquid-phase resistance to transfer was apparent. ***R. F. Taylor.*** *Chemical Engineering Science,* v. 10, nos. 1/2, Apr. 1959, p. 68-79.

10037* Absorption of CO_2 in Jets and Falling Films of Electrolyte Solutions, With and Without Chemical Reaction. Investigation of the kinetics of the absorption of CO_2 by caustic solutions. ***R. A. T. O. Nijsing, R. H. Hendriksz, and H. Kramers.*** *Chemical Engineering Science,* v. 10, nos. 1/2, Apr. 1959, p. 88-104.

10038* Research on Ion Exchangers by Means of the Percolation Technique. ***C. J. H. Wevers.*** *Chemical Engineering Science,* v. 10, no. 3, May 1959, p. 171-189.

10039 Cool Route to Compressor Savings. Cool-running centrifugals vie for compressor jobs, offering power space savings. *Chemical Week,* v. 84, no. 19, May 9, 1959, p. 106-108.

10040 Nylon-6 Grooms for Tire Competition. High-purity caprolactam puts nylon-6 in running for big tire-cord market. *Chemical Week,* v. 84, no. 20, May 16, 1959, p. 85-86.

10041 Report of the Distillation Panel Recommending Some Basic Researches. Full text of the joint publication by Association of British Chemical Manufacturers and the British Chemical Plant Manufacturers Association. *Chemistry & Industry,* 1959, no. 19, May 9, p. 585-594.

10042 Surface Tension, Density and Viscosity of Coal Tar Pitch. A knowledge of physico-chemical constants is necessary in order to select the optimum conditions for treatment and transport of medium and hard pitches, for the introduction of automatic control of processes, and also for the design of plant and pipe-lines. ***T. Ya. Gogoleva and M. A. Stepanenko.*** *Coal Tar Research Association, Report No.* 0232, May 20, 1959, 8 pp. (Translated from *Koks i Khimiya,* 1959, no. 4, p. 42-45.) (TP953 C63 Contin.)

10043* The Alkalinity of the Washing Waters of Raney Nickel. The alkalinity of the washing waters of this Ni prepared by the acid etching of a Ni-Mg alloy is chiefly due to the effect of Mg on water; the effect of Ni can be neglected. (*In French.*) Sur l'alcalinité des eaux de lavage du nickel de Raney. ***Yves Armand.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences,* v. 248, no. 15, Apr. 13, 1959, p. 2205-2207.

10044* The Use of Turbo-Machines in Plants for the Production of Nitric Acid. Chemical and thermal processes used in modern nitric acid manufacture. ***H. Meienberg.*** *Escher Wyss News,* v. 31, no. 3, 1958, p. 3-23.

10045 Fluid Dynamics and Heat Transfer. Joins theoretical aspects and quantitative data on heat transfer and fluid dynamics. Basic principles of various types of fluid are presented, which serve as a foundation for discussion of several aspects of forced-convection heat transfer. The basic energy equation for fluid flow is derived and applied to forced convection heat transfer in closed conduits and from immersed bodies. ***James G. Knudsen and Donald L. Katz.*** 576 pp. 1958. McGraw-Hill, New York. (QA913 K78f)

10046* Treatment of Low-Grade Gas Turbine Fuels. Gravitational continuous centrifuge; recycle dam system; and Gravitrol turbine fuel oil washing system. *Gas and Oil Power,* v. 54, May 1959, p. 133-135.

10047 A Horizontal Fractionating Device. The proposed column has potential usefulness because low pressure drops were obtained at high liquid and vapor loadings and with good efficiencies. ***Michael Markels, Jr. and Thomas B. Drew.*** *Industrial and Engineering Chemistry,* v. 51, May 1959, p. 619-624.

10048 Hydraulics of the Uniflux Fractionating Tray. Hydraulic data on flooding and pressure drop characteristics of the tray have been obtained. An operating range has been defined for a nitrogen-absorption oil system. ***H. M. Muller and D. F. Othmer.*** *Industrial and Engineering Chemistry,* v. 51, May 1959, p. 625-632.

10049 Upping Column Extraction Efficiency by Pulse Application—Sieve Columns. Mechanical agitation of extractor column liquids speeds up the slow separation process. ***W. M. Goldberger and R. F. Benenati.*** *Industrial and Engineering Chemistry,* v. 51, May 1959, p. 641-644.

10050 Upping Column Extraction Efficiency by Pulse Application—Packed Column. The correlation presented can be used to compute the value of HTU corresponding to a given combination of frequency and amplitude. Conversely, it can fix the pulse conditions necessary to attain a given value of HTU. ***G. V. Potnis, H. C. Bijawat and L. K. Doraiswamy.*** *Industrial and Engineering Chemistry,* v. 51, May 1959, p. 645-650.

10051 Thermal Diffusion Column Theory for Liquids. Up until now, it has been assumed that liquid properties are constant in obtaining the operating equations usually used for thermal diffusion columns. New results show that, for some systems, the effect of temperature on the properties is important. ***A. H. Emery, Jr.*** *Industrial and Engineering Chemistry,* v. 51, May 1959, p. 651-654.

10052 Control Valve Design for Viscous Pseudoplastic Fluids. Two new valve designs are proposed. One, a characterized plug-in-seat design, is especially suited to the semi-logarithmic characteristic. The other, a stepped-sliding-stem type, has essentially linear characteristics. ***E. S. DeHaven.*** *Industrial and Engineering Chemistry,* v. 51, July 1959, p. 63A-66A.

10053 Treatment and Disposal of Radio-Active Wastes. Two schemes suitable for full-scale application with little further development work. In the first, highly active effluent is evaporated, the medium active effluent being treated chemically and then adsorbed; in the second scheme, all active effluents are evaporated. ***D. H. Logsdail.*** *Industrial Chemist,* v. 35, May 1959, p. 213-220.

10054* Treatment and Control of Boiler Feed-Water: New Interpretations. Appraisal of selected features of feed-water treatment for high-pressure steam boilers is made in the light of recent information and ideas. ***E. C. Potter.*** *Institute of Fuel, Journal,* v. 32, May 1959, p. 218-224.

10055 Flow Properties of Distillates at Low Temperatures: A Review. A critical review is given of the conventional tests for assessing the lower temperature limits for use of distillate

fuels and lubricants, namely, cloud point and pour point. Mechanisms by which the additives increase fluidity are discussed. ***J. F. Hutton.*** *Institute of Petroleum, Journal,* v. 45, May 1959, p. 123-129.

10056* A Suggested Equation Relating to the Mixing of Powders and Its Application to the Study of the Performance of Certain Types of Machine. An extended equation for the performance of a machine mixing two powders is developed on the basis that a "mixing potential" and a "demixing potential" are operative. For limited classes of machine, the rate of mixing is proportional to the power absorbed and this suggests that the different rates of mixing encountered between different types of machine might largely arise from the different power consumptions involved. ***H. E. Rose.*** *Institution of Chemical Engineers, Transactions,* v. 37, no. 2, 1959, p. 47-64.

10057* Exploratory Study of the Flow of Granules Through Apertures. Measurements were made of the flow of dry granular materials from a series of cylindrical vessels ranging from 1·45 to 14·6 cm diam. through circular orifices from 0·112 to 5·03 cm diam. located centrally in horizontal bases. The materials covered a narrow range of size, the mean grain size ranging from 0·020 cm to 0·11 cm. With sufficiently wide containers, the flow-rate is independent of the container dimensions. ***R. L. Brown and J. C. Richards.*** *Institution of Chemical Engineers, Transactions,* v. 37, no. 2, 1959, p. 108-119.

10058* Plastics and Rubbers in Chemical Plant. Corrosion resistance, properties and uses of rubber and plastics for chemical plant and equipment. ***T. A. Watson.*** *Manufacturing Chemist,* v. 30, June 1959, p. 250-253.

10059 Multiwall Super-Barrier. New paper-foil-polyethylene bulk carrier, heat sealed and taped on a new machine, protects DuPont resin under tropical test conditions, opening new prospects for all hygroscopic products. *Modern Packaging,* v. 32, no. 9, May 1959, p. 80-81.

10060* The Giammarco-Vetrocoke Process for Acid-Gas Removal. The process may be used for the removal of CO_2 from gases essentially free of H_2S, or for selective H_2S removal. It is based on absorption of the acid gases in alkaline solutions containing additives. ***F. C. Riesenfeld and J. F. Mullowney.*** *Oil and Gas Journal,* v. 57, no. 20, May 11, 1959, p. 86-91.

10061* What Ohio Oil Learned in 5 Years of Processing Crude Oil at Low pH. Ohio Oil's Robinson refinery lowered pH on crude-oil overhead receiver waters and increased inhibitor injection into the vapor overhead which have resulted in excellent control of corrosion, cleaner equipment, and reduction of NH_3 contamination in the hydrocarbon streams. ***J. A. Biehl and E. A. Schnake.*** *Oil and Gas Journal,* v. 57, no. 23, June 1, 1959, p. 125-128.

10062* How to Get Optimum Use of Byproduct Hydrogen in an Integrated Oil Refinery. The refiner engaged in full-scale Pt reforming of virgin naphtha has adequate H available for hydrotreating all fractions of the crude charge, including treating of primary fractions. ***G. T. Gwin.*** *Oil and Gas Journal,* v. 57, no. 23, June 1, 1959, p. 129 + 4 pages.

10063* Small Semiautomatic Pilot Plants. Pilot-plant data provide a valuable source of useful and reliable information for planning and controlling refinery operations at Avon and Delaware refineries. ***W. M. Miller.*** *Oil and Gas Journal,* v. 57, no. 23, June 1, 1959, p. 135 + 8 pages.

10064 New Soda Ash Recovery. Description of the pulp and paper industry's first commercial scale installation of a new soda ash recovery process operating in Wisconsin. *Paper Mill News,* v. 82, no. 20, May 18, 1959, p. 24 + 2 pages.

10065* Current Developments in the Dewatering of Paper Mill Sludges. ***Harry W. Gehm.*** *Paper Trade Journal,* v. 143, June 1, 1959, p. 26-30.

10066* Recent Developments in the Oxo Process. The Oxo reaction for production of straight-chain aldehydes and alcohols is one of the few wholly novel methods of synthesis which was adopted directly in the petrochemical field. The method effects the reaction of olefins with CO and H. ***P. W. Sherwood.*** *Petroleum,* v. 22, May 1959, p. 169-172.

10067* Heat Transfer to Liquids in Intermittent Flow. The work was undertaken to find out if heat transfer to liquids could be usefully increased by using intermittent flow. Fluid in intermittent flow in a heated tube gave poorer heat transfer when the flow was controlled from downstream of the heater, but when the flow was controlled from upstream, heat transfer was improved by up to 70%. ***G. B. Darling.*** *Petroleum,* v. 22, May 1959, p. 177 + 2 pages.

10068 Modern Gasoline Plant Design. Absorption, refrigeration, and adsorption. ***Gerald D. Johnston.*** *Petroleum Engineer,* v. 31, May 1959, p. C3 + 2 pages.

10069* For Control of Refinery Processes, Use of Chromatography Grows. Gas chromatography in refineries controls processing operations automatically and effectively. *Petroleum Week,* v. 8, no. 19, May 8, 1959, p. 40.

10070* First RDC Lube Extractor Goes on Line. A rotating disc contactor developed by Royal Dutch Shell Laboratories in Europe for lube oil extraction is scheduled to go on stream at the Wood River, Illinois, lube oil plant. *Petroleum Week,* v. 8, no. 20, May 15, 1959, p. 137-138.

10071 The Oil Ash Corrosion Problem. An Application of the Phase Equilibrium Approach. The inorganic impurities present in petroleum tend to concentrate in the heavy oil fraction and during combustion form a corrosive slag known as oil ash. Shows how this problem has been solved, largely by phase equilibria studies, which can be applied to many other problems. ***W. R. Foster.*** *Research,* v. 12, May 1959, p. 189-195.

10072* Filtration of Acid Mists and Fumes. Describes a new fiber filter which virtually eliminates the emission of very fine acid mist particles from tail gases. *Sulphur,* no. 24, Apr. 1959, p. 37-38.

10073 Modern Mineral Oil Processing Techniques. A survey of petroleum treatment covering distillation, thermal and catalytic cracking with moving or fluidized beds, reforming combined or not with extracting, isomerization, polymerization, alkylation, and hydrotreating. (*In German.*) Moderne Erdölverarbeitungstechnik. ***H. Prinzler.*** *Technik,* v. 14, May 1959, p. 347-354.

10074 Chemical Engineering Division Summary Report. October, November, December, 1958. Includes fluoride volatilization separations process, fluidization studies, reactor chemistry, and chemical-metallurgical processing. ***Stephen Lawroski.*** *U. S. Atomic Energy Commission, ANL-5959,* Mar. 1959, 171 pp. (UF767 Un3.1an Contin.)

10075 Effect of Pressure on Mass Transfer in the Gas Phase. ***Robert Joseph Fallat.*** *U. S. Atomic Energy Commission, UCRL-8527,* Mar. 1959, 53 pp. (UF767 U3u Contin.)

10076 Longitudinal Dispersion in Packed Extraction Columns. Longitudinal dispersion (axial mixing) was studied for counter-current flow of liquids through packed beds, using six different combinations of packing type and size and bed arrangements. ***Gabriel L. Jacques, John E. Cotter, and Theodore Vermeulen.*** *U. S. Atomic Energy Commission, UCRL-8658,* Apr. 1959, 71 pp. (UF767 U3u Contin.)

10077 Some Thermodynamic Properties of Fluorphlogopite Mica. Measurements were made of the heat of formation at 298 K., the heat capacity between 50 and 298 K., the entropy at 298 K., and the heat-content and entropy increments between 298 K., and a maximum of 1,804 K. Heats and free energies of formation of the mica from the elements and from molecular constituents at temperatures ranging from 298 to 1800 K. are determined. ***K. K. Kelley, R. Barany, E. G. King, and A. U. Christensen.*** *U. S. Bureau of Mines Report of Investigations* 5436, 1959, 16 pp. (TN21 Un3r Vis.)

10078* Fatty Oils for Odor Removal. A new method of water treatment. The oil used may be removed by flocculation of ferric hydroxide. Strong-smelling compounds are obtained from the oil-bearing floc by steam distillation or vacuum treatment. ***C. Boelhouwer, R. Syderius, M. Tels, and H. I. Waterman.*** *Water & Sewage Works,* v. 106, May 1959, p. 188-190.

10079* Water Softening. III. Cation Exchange. ***George E. Symons.*** *Water & Sewage Works*, v. 106, May 1959, p. 193-198.

10080* Treatment of Waste Acid and Effluent From Continuous Strip Pickling Lines. ***A. E. Matthews.*** *Wire Industry*, v. 26, May 1959, p. 453 + 6 pages.

10081* Here's How New Additives Improve Deep Well Cementing. Additives decrease setting time, lower water loss, and control density. ***J. O. Woodson and C. L. Fulton.*** *World Oil*, v. 148, May 1959, p. 171-177.

See also: **10503** (low-temperature coal tar studies); **10612** (moisture measurement).

CHEMISTRY—ANALYTICAL

10082* Indirect Mercurimetric Determination of Cadmium, Cobalt, Nickel, and Zinc With the Use of Their Pyridine-Thiocyanate Complexes. (*In German.*) Über eine indirekte merkurimetrische Bestimmungsmethode des Cadmiums, Kobalts, Nickels und Zinkes durch ihre Pyridin-Rhodanidkomplexe. ***J. Bognár and Sz. Sárosi.*** *Acta Chimica Academiae Scientiarum Hungaricae*, v. 19, no. 1, 1959, p. 41-49.

10083* Comparative Photometrical Determination of the Cobalt Content in Aluminium and Its Alloys. Comparison of the photometrical determination of the Co content by the nitric acid method and the Nitroso-R-salt method. (*In German.*) Vergleichende photometrische Kobaltbestimmungen in Aluminium und seinen Legierungen. ***H. Pohl.*** *Aluminium (Dusseldorf)*, v. 35, May 1959, p. 260-261.

10084 A Colorimetric Assay for Unoxidized Phenothiazine Derivatives: A New Complex Salt. Lauryl sulfate salts of palladium phenothiazine derivative complexes provide a colorimetric means of following oxidative decomposition in such pharmaceutically important compounds as promazine, promethazine, and chlorpromazine. ***James A. Ryan.*** *American Pharmaceutical Association, Journal (Scientific Ed.)*, v. 48, Apr. 1959, p. 240-243.

10085 The Spectrophotometric Assay for Chlortetracycline HCl and Tetracycline HCl in Pharmaceuticals. Specific assays developed for chlortetracycline and tetracycline based on the formation of anhydro compounds and the fact that chlortetracycline heated at pH 7.5 is cleaved to isochlortetracycline while tetracycline under the same conditions is relatively stable. ***Fortunato S. Chiccarelli, Mason H. Woolford, Jr., and Maurice E. Avery.*** *American Pharmaceutical Association, Journal (Scientific Ed.)*, v. 48, May 1959, p. 263-268.

10086 The Identification and Determination of Some Official Local Anesthetics as Tetraphenylborates. Tetraphenylborates may be prepared by interacting the hydrochlorides of the organic bases with sodium tetraphenylboron in aqueous citrate buffers at a pH of 6.0. ***L. G. Chatten, M. Pernarowski, and L. Levi.*** *American Pharmaceutical Association, Journal (Scientific Ed.)*, v. 48, May 1959, p. 276-283.

10087 Nonaqueous Titration of Organic Acids, Anhydrides, Acyl Halides, Strong Inorganic Acids, and Reactive Alkyl Halides in Various Mixtures. Standard bases employed are tributylamine in dioxane, sodium methoxide in methanol-benzene, and Triton B in pyridine. ***Abraham Patchornik and Sarah Ehrlich Rogozinski.*** *Analytical Chemistry*, v. 31, June 1959, p. 985-989.

10088 Gas Chromatographic Analysis of Various Mixtures of Compounds Containing Chlorine. Method developed for the analysis of unrefined 1,2-dichloroethane, refined CCl_4, and chloroform because other instrumental and/or chemical techniques were not applicable. ***G. W. Warren, L. J. Priestley, Jr., J. F. Haskin, and V. A. Yarborough.*** *Analytical Chemistry*, v. 31, June 1959, p. 1013-1016.

10089 Analysis of Mixtures of Amino Acids by Gas Phase Chromatography. Amino acids were converted to their *N*-acetyl butyl esters prior to chromatography and the esters fractionated on a column of firebrick coated with a hydrogenated vegetable oil. ***C. G. Youngs.*** *Analytical Chemistry*, v. 31, June 1959, p. 1019-1021.

10090 Gas Chromatographic Analysis of Hydrocarbon Streams From Butane Dehydrogenation. Procedures are described for the separation and analysis of all hydrocarbon gases from hydrogen through C_4 using columns at room temperature. ***Thomas A. McKenna, Jr. and John A. Idleman.*** *Analytical Chemistry*, v. 31, June 1959, p. 1021-1023.

10091 Determination of Amino Acids From Plants by Paper Chromatography. ***John F. Thompson and Clayton J. Morris.*** *Analytical Chemistry*, v. 31, June 1959, p. 1031-1037.

10092 Thermistorized Apparatus for Differential Thermal Analysis. Application for determination of thermograms of nitrate esters of cellulose and pentaerythritol. ***Jack M. Pakulak, Jr. and Guy William Leonard.*** *Analytical Chemistry*, v. 31, June 1959, p. 1037-1039.

10093 Quantitative Infrared Analysis From Published Data. Synthetic mixtures have been used to demonstrate that published absorption spectra can be used for quantitative analysis. Analyses set up in different laboratories can yield, aside from indeterminate errors, precise, identical results. ***J. A. Perry.*** *Analytical Chemistry*, v. 31, June 1959, p. 1054-1055.

10094 Determination of Iron, Chromium, and Nickel by Fluorescent X-Ray Analysis. Aqueous Solution Method. ***William W. Houk and Louis Silverman.*** *Analytical Chemistry*, v. 31, June 1959, p. 1069-1072.

10095 Determination of Uranium and Beryllium in Fused Fluoride Systems. Quantitative separation and determination of U and Be in the presence of macro quantities of Na in a ternary system of fused fluorides. ***N. E. Rogers and W. D. Prather.*** *Analytical Chemistry*, v. 31, June 1959, p. 1081-1084.

10096 Determination of the Ratio of Methyl to Phenyl Groups in Silicone Polymers. ***J. Harold Lady, George M. Bower, Robert E. Adams, and F. P. Byrne.*** *Analytical Chemistry*, v. 31, June 1959, p. 1100-1102.

10097 Determination of Platinum and Palladium in Ores and Concentrates. New fire assay method. ***M. E. V. Plummer and F. E. Beamish.*** *Analytical Chemistry*, v. 31, July 1959, p. 1141-1143.

10098 Photometric Titration of Scandium. Scandium solution containing Cu(II) can be titrated photometrically in acid solution with EDTA in the presence of up to 60 times as much rare earth. ***James S. Fritz and Donald J. Pietrzyk.*** *Analytical Chemistry*, v. 31, July 1959, p. 1157-1159.

10099 Spectroscopic Techniques for Identification of Organosilicon Compounds. Techniques for examining both organosilicon monomers and polymers. ***A. Lee Smith and J. A. McHard.*** *Analytical Chemistry*, v. 31, July 1959, p. 1174-1179.

10100 Derivative Thermoanalytical Techniques. Instrumentation and Applications to Thermogravimetry and Differential Thermal Analysis. ***Clement Campbell, Saul Gordon, and Chester L. Smith.*** *Analytical Chemistry*, v. 31, July 1959, p. 1188-1191.

10101 Rapid Quantitative Determination of Amino Acids by High Temperature Paper Chromatography. Horizontal paper chromatography is used for quantitative determination of the amino acid composition of a mixture of amino acids or a protein hydrolyzate in a small sealed horizontal development tank. ***J. B. Himes and L. D. Metcalfe.*** *Analytical Chemistry*, v. 31, July 1959, p. 1192-1194.

10102 Gas Chromatography. Effect of Sample Size on Height of Equivalent Theoretical Plate and Retention Volume. ***R. M. Bethea and Morton Smutz.*** *Analytical Chemistry*, v. 31, July 1959, p. 1211-1214.

10103 Gravimetric Determination of Cellulose Acetate in Double-Base Propellants. ***Aaron N. Fletcher, Raymond H. Pierson, and E. St. Clair Gantz.*** *Analytical Chemistry*, v. 31, July 1959, p. 1224-1226.

10104 Platinum-Flux Technique for Determining Oxygen in Titanium. An investigation was made of the reproducibility of the Pt bath technique for determining O in Ti and its alloys. The accuracy of the dry-crucible and the Pt-flux techniques as applied to unalloyed Ti, and one alloy, Ti-6Al-4V, was determined by using standard samples. Both techniques appeared capable of recovering at least 92% of the O in unalloyed Ti standards. Average O recovery from Ti-6Al-4V alloy standards was 93% by both the Pt-flux and the dry-crucible techniques. Studies on the reproducibility of analytical values made on three other alloys, Ti-8Mn, Ti-2Fe-2Cr-2Mo, and Ti-5Al-2.5Sn, indicated that satisfactory results could be obtained by both techniques. ***W. R. Hansen, M. W. Mallett, and M. J. Trzeciak.*** *Analytical Chemistry*, v. 31, July 1959, p. 1237-1241.

10105 Semimicrodetermination of Combined Tantalum and Niobium With Selenous Acid. Tantalum and niobium are separated and determined gravimetrically by precipitation with selenous acid from highly acidic solutions in the absence of complexing agents. Method is applied to the determination of the earth acids in tantaloniobate ores. ***F. S. Grimaldi and Marian Schnepfe.*** *Analytical Chemistry*, v. 31, July 1959, p. 1270-1272.

10106* Determination of Mercapto Groups in Ovalbumin With Ferricyanide. Precise determination of the mercapto-group content of denatured ovalbumin has been made with potassium ferricyanide in phosphate buffer at pH 7.1 by means of a novel amperometric method. ***J. M. Katyal and George Gorin.*** *Archives of Biochemistry and Biophysics*, v. 82, no. 2, June 1959, p. 319-329.

10107* Apparatus for Carbon Content Determination. The lay-out of the carbon room, type of furnaces used, and oxygen control system of an iron and steel industry analytical laboratory are described. ***R. Rew.*** *B.C.I.R.A. Journal of Research and Development*, v. 7, no. 11, Apr. 1959, p. 651-655 + 4 plates.

10108 Possibility of Analyzing Steel for Alloying Elements in Electric Furnaces Without Taking Samples. Experimental work at two electric furnaces on photographing the arc spectrum, using the furnace arc as source of excitation, to determine the alloying elements directly in the steel bath. Merits of proposed technique for large-capacity arc furnaces; and its promise for the open-hearth furnace. ***V. N. Balandin and S. L. Mandel'shtam.*** *Henry Brutcher Translation No.* 4472, 8 pp. (From *Zavodskaya Laboratoriya*, v. 23, no. 5, 1957, p. 545-548.) Henry Brutcher, Altadena, Calif.

10109 Rapid Analysis of Ores and Similar Materials. Rapid procedures for photometric determination of Fe, Mn, SiO_2, P, CaO, MgO, Al_2O_3, and TiO_2, also Cu, Cr, and Pb in ores and similar substances, from the same sample, after decomposition with borax. ***A. Neuberger, E. Schoffmann, and K. Herkenhoff.*** *Henry Brutcher Translation No.* 4501, 19 pp. (From *Archiv f. d Eisenhüttenwesen*, v. 29, no. 9, 1958, p. 547-552.) Henry Brutcher, Altadena, Calif.

10110 Chemical Analysis. v. III. Colorimetric Determination of Traces of Metals. Survey of the literature on the separation and colorimetric determination of metal traces which has appeared since 1950. ***E. B. Sandell.*** 3rd Rev. Ed. 1032 pp. 1959. Interscience Publishers, New York. (QD133 Sa56c3)

10111* Analysis of Organic Compounds by Flame Spectrometry. I. Determination of Chlorine in Organic Compounds by Band Spectra of Cuprous Chloride. ***Masao Maruyama and Setsuya Seno.*** *Chemical Society of Japan, Bulletin*, v. 32, no. 5, May 1959, p. 486-490.

10112* Organic Spot Tests. I. Detection of Acidic Compounds. Griess test for nitrites has been found to be used conversely for the detection of very small quantities of acidic compounds. ***Yujiro Nomura.*** *Chemical Society of Japan, Bulletin*, v. 32, no. 5, May 1959, p. 536.

10113* The Separation, Detection and Identification of Surface-Active Agents Derived From Polyethylene Glycol (Carbowax) Added to Edible Fats. Qualitative and quantitative method is described for the screening and eventual determination of surface active derivatives of polyethylene glycol (carbowax) added to edible fats, after isolation from the latter. (*In Italian.*) Isolamento, ricerca e determinazione dei tensioattivi derivati dal glicole polietilenico (carbowax) aggiunti ai grassi commestibili. ***S. Anselmi, L. Boniforti, and R. Monacelli.*** *Chimica e l'Industria*, v. 41, May 1959, p. 421-424.

10114 Fifteenth International Conference of Pure and Applied Chemistry (Analytical Chemistry). Transactions of the Conference (September 8-16, 1956). v. I. Most of this book is made up of lectures and reports presented at the chemical congress held in Lisbon in 1956. Such subjects were covered as the analysis of macromolecular and colloidal systems, gas-liquid chromatography, organic spot test analysis, organic complexing agents, adsorption kinetics, and electrode processes, etc. (*In Portuguese and English.*) XV Congresso Internacional de Química Pura e Aplicada (Química Analítica). Actas do Congresso (8 a 16 de Setembro de 1956). v. I. 1028 pp. 1957. Ramos, Afonso & Moita, Lisbon, Portugal. (QD1 In8p)

10115 Exploration of the Best Conditions of Quantitative Spectrographic Analysis of Substances in Powder. Following the suggestion of Bujanov the conditions of quantitative spark tests of substances in powder by means of a Ni or Cu plate have been established. A simple apparatus provided with a mechanical feed to maintain exact exciting conditions has been designed. As second alternative of spark tests of substances in powder, the spark tests of briquettes have been used. The optimum conditions of centered and eccentric spark tests have been determined and a simple device maintaining accurate test conditions has been constructed. (*In Czech.*) Vyšetření nejvhodnějších podmínek kvantitativního spektrografického stanovení látek ve formě práškové. ***František Plzák and Boh. Lizal.*** *Hutnické Listy*, v. 14, no. 4, Apr. 1959, p. 297-301.

10116* Alkalimetric Determination of Phosphorus as Quinoline Phosphomolybdate. Methods for determination of P in steel are given, based on investigation on importance of initial acidity of sample solution. (*In Swedish.*) Alkalimetrisk bestämning av fosfor som kinolinfosfomolybdat. ***Göran Alfelt.*** *Jernkontorets Annaler*, v. 143, no. 3, 1959, p. 167-174.

10117* Separation and Determination of Phosphate, Silicate, and Arsenate. The quantitative separation and determination of these ions when they occur together in solution. ***W. Stanley Clabaugh and Audrey Jackson.*** *Journal of Research, National Bureau of Standards*, v. 62, no. 5, May 1959, p. 201-205.

10118* Paper Chromatographic Analysis of Dicarboxylic Acids in Polyesters. Conversion of dicarboxylic acids in polyesters by means of saponification of the ester with alcoholic alkali. Paper chromatographic methods of separation and identification of the dicarboxylic acids frequently found in polyesters, in an ester mixture as well as after hydrolysis of the ester. (*In German.*) Zur papierchromatographischen Analyse der Dicarbonsäuren in Polyestern. ***P. Fijolka, R. Kayler, and I. Lens.*** *Kunststoffe*, v. 49, May 1959, p. 222-225.

10119* The Determination of Fatty Acid Composition by Gas Chromatography and U. V. Spectrophotometric Methods. ***L. Malin.*** *Laboratory Practice*, v. 8, June 1959, p. 226-228.

10120* Flame Photometric Microdetermination of Sodium, Potassium and Calcium in Tungsten Metals and Tungsten Oxides. The new method described makes it possible to determine up to 10^{-5}% Na, or 10^{-2} to 10^{-4}% K and Ca in W-metal and W-oxides. Tungsten is displaced by CCl_4. Sodium, K, and Ca are determined in the residue by flame spectral analysis. In principle, the method can be used for the determination of any alkali- and earth alkali metals. (*In Hungarian.*) Nátrium, kálium és kalcium lángfotométeres mikromeghatározása volframfémben és volframoxidokban. ***András Hegedüs, Jenö Neugebauer, and Magda Dvorszky.*** *Magyar Kémiai Folyóirat*, v. 65, no. 4, Apr. 1959, p. 159-164.

10121 Methods of Silicate Analysis. ***H. Bennett and W. G. Hawley.*** 159 pp. 1958. The British Ceramic Research Association, Stoke-on-Trent, England. (TP810 B43m)

10122 Effect of the Carrier Gas on the Sensitivity of Thermal Conductivity Detectors in Gas Chromatography. Disadvantages of carrier gases of low thermal conductivity. ***B. A. Scott and A. G. Williamson.*** *Nature*, v. 183, May 9, 1959, p. 1322-1323.

10123 Some Practical Aspects of X-Ray Spectrography. Brief summary-type discussion of the principal factors involved in X-ray spectrography. Describes techniques of sample preparation, the analysis of a variety of heterogeneous samples, and other applications such as the measurement of film thickness. ***Maurice C. Lambert.*** *Norelco Reporter*, v. 6, no. 2, Mar.-Apr. 1959, p. 37-51.

10124 Separation of Hydrogen Isotopes by Gas-Solid Chromatography. Chromatographic analysis of mixtures of H_2, HT, and T_2 on a "molecular sieve" column. This technique may find valuable applications in various kinetic investigations. ***Preston L. Gant and Kang Yang.*** *Science*, v. 129, June 5, 1959, p. 1548-1549.

10125* The Determination of Fatty Acid Composition. Gas chromatography and U.V. spectrophotometirc methods. ***L. Malin.*** *Soap, Perfumery & Cosmetics*, v. 32, June 1959, p. 597-599.

10126* Analytical Applications of Far Infrared Spectra. II. Spectra-Structure Correlations for Aliphatic and Aromatic Hydrocarbons in the Cesium Bromide Region. Infrared absorption spectra of some 400 aliphatic and aromatic hydrocarbons have been investigated from 15 to 35μ and the characteristic absorption frequencies incorporated into spectra-structure correlation charts. ***F. F. Bentley and E. F. Wolfarth.*** *Spectrochimica Acta*, 1959, nos. 3/4, May 1959, p. 165-205.

10127* Analysis of Aluminium and Aluminium-Base Alloys Using d.c. Arc. Al and Al-alloys are analyzed directly using d.c. arc excitation. The improved electrode type described eliminates difficulties from the rapid oxidation of Al. ***J. Haaland.*** *Spectrochimica Acta*, 1959, nos. 3/4, May 1959, p. 276-280.

10128* Determination of Certain Rare Earth Elements by the Flame Spectrophotometry Method. Description of an electronic self-recording flame spectrophotometer built on the basis of the monochromator type YM2. Elements such as La, Eu, Y, and Yb were determined in global amounts of rare earths and in preparations of different individual earths. (*In Russian.*) Opredelenie nekotorykh redkozemel'nykh elementov po metodu spektrofotometrii plameni. ***N. S. Poluektov and M. P. Nikonova.*** *Ukrainskiĭ Khimicheskiĭ Zhurnal*, v. 25, no. 2, 1959, p. 217-225.

10129 Analysis of Uranium Solutions Using Anion Exchange in Nitrate Media. Method for the separation of milligram quantities of U from gross quantities of other elements in a nitrate medium has been developed. ***O. A. Vita, C. F. Trivisonno, and C. W. Phipps.*** *U. S. Atomic Energy Commission, GAT*-283, Apr. 28, 1959, 14 pp. (UF767 Un3.1ga Contin.)

10130 Analysis for Neptunium by Controlled Potential Coulometry. Accurate and precise method for the determination of Np was developed using a controlled potential coulometer. ***R. W. Stromatt.*** *U. S. Atomic Energy Commission, HW*-59447, Feb. 2, 1959, 20 pp. (UF767 Un3.1hw Contin.)

10131 Neutron Activation Analysis Methods for the Group VIII Elements. Principles of activation analysis. Nuclear properties of the group VIII elements. Measurement of radioactivity. Comparison of counting methods. Optimum counting rate. Limits of quantitative measurement of the group VIII elements. Use of (n,p) reactions in the determination of group VIII elements. Use of short-lived radionuclides in activation analysis. ***C. E. Miller.*** *U. S. Atomic Energy Commission, ORNL*-2715, May 21, 1959, 108 pp. (UF767 U3o Contin.)

10132 The Determination of Mercury, Copper, and Zinc by Derivative Polarography—Application to Solutions of Uranyl Sulfate Containing Corrosion Products. ***R. G. Ball, D. L. Manning, and O. Menis.*** *U. S. Atomic Energy Commission, ORNL*-2717, May 25, 1959, 27 pp. (UF767 U3o Contin.)

10133 Analytical Chemistry in Nuclear Reactor Technology. Specific applications of diverse methods of chemical analysis. Instrumentation, remote control techniques, and nucleonics. Second conference held at Gatlinburg, Tenn., Sept. 29-Oct. 1, 1958. *U. S. Atomic Energy Commission, TID*-7568, (Pts. 1-2), Apr. 1959, 298 and 236 pp. (UF767 Un3ti Contin.)

10134* Method of Hydrogen Determination Based on the Chemical Composition and on the Structure of Steel. Determining H by heating in a vacuum was applied to steel with a 0.5% C content. Vacuum melting is required by steels containing more C, or Ti or Mn. Heating in vacuum must be applied to steels containing Cr. It can be used, whatever the C content is, with steels containing Nb, Ni, and Al. (*In Russian.*) Metody opredeleniia vodoroda v zavisimosti ot khimicheskogo sostava i struktury stali. ***Iu. A. Kliachko and T. A. Izmanova.*** *Zavodskaia Laboratoriia*, v. 25, no. 4, 1959, p. 396-398.

10135* Omega Chrome Fast Blue 2G: A New Metal Indicator for EDTA Titrations. Omega Chrome Fast Blue 2G was used as an indicator for the direct titration of Ca, Mg, Mn, and Ni. A displacement reaction was described for the titration of Pb and Cd. Fenugreek mucliage, a colorless polysaccharide, was used as medium for spot tests. ***A. A. Abd El Raheem.*** *Zeitschrift für Analytische Chemie*, v. 167, no. 2, 1959, p. 98-104.

10136* Fluorimetric Determination of Boron With Resacetophenone as a Reagent. Method has the advantage that the reaction does not require much time, because the fluorescence intensity reaches its maximum immediately after mixing the reagents and does not also decrease with time. ***G. Gopala Rao and N. Appalaraju.*** *Zeitschrift für Analytische Chemie*, v. 167, no. 5, 1959, p. 325-329.

10137* Analytical Aspects of Some Organic Acids. III. Gravimetric Estimation of Thorium by m-Phenylenedioxydiacetic Acid. m-Phenylenedioxydiacetic acid gives a white precipitate with Th which is quantitative up to pH 4, even in the absence of an electrolyte. ***C. S. Pande and T. S. Srivastava.*** *Zeitschrift für Analytische Chemie*, v. 167, no. 5, 1959, p. 332-335.

10138* Spectrophotometric Study of Colored Complexes of Tetravalent Tin With Some Reagents Containing OH-Groups. Comparative spectrophotometric study of some hydroxyanthraquinones, quercetine, hematoxylin, and stilbazo as reagents for tetravalent Sn. Most sensitive reagent for the qualitative detection of Sn is stilbazo. (*In Russian.*) Spektrofotometricheskoe issledovanie okrashennykh kompleksov chetyrekhvalentnogo olova s nekotorymi reaktivami, soderzhashchimi on-gruppy. ***A. K. Babko and T. N. Nazarchuk.*** *Zhurnal Analiticheskoĭ Khimii*, v. 14, no. 2, Mar.-Apr. 1959, p. 174-180.

10139* Separation of Thorium From Rare Earths With Tannin. Thorium is quantitatively precipitated with tannin in a 0.005 *N* solution of HNO_3 or HCl. This permits its separation from trivalent rare earths. (*In Russian.*) Otdelenie toriia ot redkozemel'nykh elementov tanninom. ***N. I. Vlodavets.*** *Zhurnal Analiticheskoĭ Khimii*, v. 14, no. 2, Mar.-Apr. 1959, p. 202-206.

10140* New Sensitive Reactions for the Detection of Copper Ion. New selective catalytic reaction for detecting Cu ion is based on speeding up of the oxidation of the *o*-aminophenol ammonia solution with air. This can be noticed due to the more rapid change of the solution color in the presence of Cu. (*In Russian.*) Novye chuvstvitel'nye reaktsii dlia otkrytiia iona medi. ***M. Ia. Shapiro and Sh. I. Iablunovskiĭ.*** *Zhurnal Analiticheskoĭ Khimii*, v. 14, no. 2, Mar.-Apr. 1959, p. 246-247.

See also: **10369** (analysis of electroplating baths); **10523** (determinations of Ga and Ge); **10590** (spectral data file); **10609** (chemical balance); **10707** (determination of case carbon content of carburized steel).

CHEMISTRY—INORGANIC AND GENERAL

10141* Preparation and Properties of Dichloro-phosphoric Acid. Pure, crystallizable dichloro-phosphoric acid $H[PO_2Cl_2]$ can be prepared by subjecting pyrophosphoryl chloride $P_2O_3Cl_4$ to quantitative hydrolysis with the theoretical quantity of water at temperatures below −30 C, in order to

split the bond P–O–P. (*In German.*) Darstellung und Eigenschaften der Dichlorphosphorsäure. ***H. Grunze.*** *Acta Chimica Academiae Scientiarum Hungaricae*, v. 18, nos. 1-4, 1959, p. 303-312.

10142 Isotopic Exchange Reactions in Liquid Sulfur Dioxide. V. The Acid Halide-Catalyzed S^{35}-Exchange Between Thionyl Chloride and Sulfur Dioxide. VI. Mixed Acidic and Basic Catalysts and the S^{35}-Exchange Between Thionyl Chloride and Sulfur Dioxide. ***David E. Burge and T. H. Norris.*** *American Chemical Society, Journal*, v. 81, May 20, 1959, p. 2324-2332.

10143 The Preparation of Some Ternary Oxides of the Platinum Metals. Ternary oxides of the alkaline earth ions with Ru, Rh, Ir, and Pt have been prepared. ***John J. Randall and Roland Ward.*** *American Chemical Society, Journal*, v. 81, June 5, 1959, p. 2629-2631.

10144 Preparation and Properties of Pentafluoroselenium Hypofluorite (F_5SeOF) and Bis(pentafluoroselenium) Peroxide ($F_5SeOOSeF_5$). ***Grihapati Mitra and George H. Cady.*** *American Chemical Society, Journal*, v. 81, June 5, 1959, p. 2646-2648.

10145 A Structural Change in Iron(II) Bromide Near 400°. ***N. W. Gregory and H. Edward O'Neal.*** *American Chemical Society, Journal*, v. 81, June 5, 1959, p. 2649-2652.

10146 Crystalline Dioxanates and Aquodioxanates of Iron(III) Chloride and Tetrachloroferric(III) Acid. ***Patrick A. McCusker, T. J. Lane, and S. M. Scholastica Kennard.*** *American Chemical Society, Journal*, v. 81, June 20, 1959, p. 2974-2976.

10147 Crystal Field Explains Inorganic Behavior. Geometry—and electron interaction—hold the key to the behavior of coordination compounds. ***Ralph G. Pearson.*** *Chemical and Engineering News*, v. 37, no. 26, June 29, 1959, p. 72-76.

10148* Preparation of Chromium-51 of a High Specific Activity by the Szilard-Chalmers Process. Preparation of highly enriched Cr^{51} by the Szilard-Chalmers process with neutron-irradiated, highly stable dye, Palatine Fast Blue GGN. ***Nagao Shibata and Kenji Yoshihara.*** *Chemical Society of Japan, Bulletin*, v. 32, no. 4, Apr. 1959, p. 422-424.

10149 Chemistry of Uranium. Collected Papers. Books I-II. Preparation, purification, reactions, compounds, properties, and structures. ***Joseph J. Katz, editor.*** 428 pp. 1958. U. S. Atomic Energy Commission, Oak Ridge, Tenn. (QD181.U7 K15co)

10150* The Photolytic Preparation of Uranium Tetrafluoride. ***D. Patnaik and Balaram Sahoo.*** *Indian Academy of Sciences, Proceedings*, v. 49, sec. A, no. 4, Apr. 1959, p. 200-202.

10151 The Chemistry of Protactinium. IV. Some Spectrophotometric Observations. True solutions of protactinium in HCl, above 4 N in acid, are free from absorption bands down to at least 300 mμ. Color reactions with organic reagents are described. ***A. T. Casey and A. G. Maddock.*** *Journal of Inorganic and Nuclear Chemistry*, v. 10, nos. 1/2, Apr. 1959, p. 58-68.

10152 The Fluorides of Uranium. III. Kinetic Studies of the Fluorination of Uranium Tetrafluoride by Fluorine. IV. Kinetic Studies of the Fluorination of Uranium Tetrafluoride by Chlorine Trifluoride. III. ***V. Y. Labaton and K. D. B. Johnson.*** IV. ***V. Y. Labaton.*** *Journal of Inorganic and Nuclear Chemistry*, v. 10, nos. 1/2, Apr. 1959, p. 74-93.

10153 Second United Nations International Conference on the Peaceful Uses of Atomic Energy, Proceedings. v. XXIX. Chemical Effects of Radiation. A total of some 60 papers are grouped as follows: irradiation of aqueous, organic, polymer, and miscellaneous systems; general studies; utilization of fission product energy; radiation sources. United Nations, Geneva. 1958, 475 pp. (QC770 In8p2 Over.)

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10155* Phase Changes in In_2Se_3. Two phases of In_2Se_3 have been detected by Debye-Scherrer-diagrams. ***P. C. Newman.*** *Zeitschrift für Anorganische und Allgemeine Chemie*, v. 299, nos. 3-4, Mar. 1959, p. 158-159.

10156* The Reaction of Sodiumborohydride and Water. Velocity of the hydrogen-development during the reaction of $NaBH_4$ with H_2O shows that the first hydrogen atom reacts faster than the other three. During heating of the hydrolysis products water only is separated. (*In German.*) Die Reaktion Natriumborhydrid und Wasser. ***J. Goubeau and H. Kallfass.*** *Zeitschrift für Anorganische und Allgemeine Chemie*, v. 299, nos. 3-4, Mar. 1959, p. 160-169.

CHEMISTRY—ORGANIC

10157* The Oxidation of Emulsified 1-*p*-Menthene With Molecular Oxygen. ***Väinö E. Veijola and Atso O. Ilvespää.*** *Acta Chemica Scandinavica*, v. 13, no. 2, 1959, p. 301-311.

10158* Synthesis of Phenolic Alkamine Ethers of Adrenaline and Some Related Compounds. Both of the possible isomers of the phenolic dimethylaminoethyl monethers of adrenaline were synthesized. The corresponding ethers of *meta* and *para*-synephrine were also prepared. ***Jaakko Hukki and Erkki Honkanen.*** *Acta Chemica Scandinavica*, v. 13, no. 2, 1959, p. 329-333.

10159* New Methods for the Synthesis of Organosiloxanes. (*In Russian.*) Novye metody sinteza organosiloksanov. ***N. F. Orlov and B. N. Dolgov.*** *Akademiia Nauk SSSR, Doklady*, v. 125, no. 4, Apr. 1, 1959, p. 817-820.

10160* The Dehydrogenation of Normal Hexane on an Aluminium-Chromium Catalyst. The Al-Cr catalyst without alkaline additions proved to be the best. At 450-500 C, under certain conditions, 20% of unsaturated hydrocarbons were obtained. The authors succeeded in nearly complete suppression of aromatization. (*In Russian.*) Degidrogenizatsiia *n*-geksana na aliumokhromovom katalizatore. ***E. A. Timofeeva, N. I. Shuikin, Iu. N. Plotnikov, and V. M. Kleĭmenova.*** *Akademiia Nauk SSSR, Doklady*, v. 125, no. 6, Apr. 21, 1959, p. 1272-1274.

10161* Synthesis and Properties of Alkylindanes With a Substituent in the Five-Member Ring. The production of alkylindanes with a substituent by way of interaction of indane with ketones by the method of Thiele is described. Colorless isopropyl indane was obtained as the result of repeated vacuum distillation of the hydration product. (*In Russian.*) Sintez i svoĭstva Aikilindanov s Zamestitelem v Piatichlennom Kol'tse. ***A. V. Topchiev, N. E. Tsytovich, and E. S. Pokrovskaia.*** *Akademiia Nauk SSSR, Doklady*, v. 125, no. 6, Apr. 21, 1959, p. 1275-1276.

10162 Direct Dimerization of Terminal Olefins by Ionizing Radiation. Low molecular weight polymers were the principal products. ***Priscilla C. Chang, N. C. Yang, and C. D. Wagner.*** *American Chemical Society, Journal*, v. 81, May 5, 1959, p. 2060-2064.

10163 Alkylation of *p*-Cresol: Effect of High Concentrations of Boron Trifluoride Catalyst. ***S. Paul Malchick and Roy B. Hannan.*** *American Chemical Society, Journal*, v. 81, May 5, 1959, p. 2119-2122.

10164 Reduction of Vinylaromatic Nitro Derivatives. Using either Zn and NH_4Cl, or Al amalgam in moist ether, *o*, *m*, and *p*-nitrostyrenes, -stilbenes and -cinnamic acids are reduced to corresponding amines. ***J. H. Boyer and H. Alul.*** *American Chemical Society, Journal*, v. 81, May 5, 1959, p. 2136-2137.

10165 Thermal Degradation of Alkyl N-Phenylcarbamates. ***Elizabeth Dyer and George C. Wright.*** *American Chemical Society, Journal,* v. 81, May 5, 1959, p. 2138-2143.

10166 The Reaction of Vinyl Sulfides and Alkyl Sulfides With Butyllithium. A new synthesis of vinyl sulfides is reported which involves the elimination of phenylmercaptide from 1,2-bis-(phenylmercapto)-ethane by reaction with phenyllithium. ***William E. Parham and Robert F. Motter.*** *American Chemical Society, Journal,* v. 81, May 5, 1959, p. 2146-2148.

10167 A Novel Route to 9α-Halo-11β-acyloxycorticosteroids. ***C. H. Robinson, L. Finckenor, M. Kirtley, David Gould, and Eugene P. Oliveto.*** *American Chemical Society, Journal,* v. 81, May 5, 1959, p. 2195-2198.

10168 Atisine. The Synthesis of 1-Methyl-6-ethyl-3-azaphenanthrene. ***David M. Locke and S. William Pelletier.*** *American Chemical Society, Journal,* v. 81, May 5, 1959, p. 2246-2250.

10169 A New Synthesis of 3,4-Dichlorocoumarins. Synthesis involves the $AlCl_3$-catalyzed reaction of perchloropropylene with phenols. ***Melvin S. Newman and Sidney Schiff.*** *American Chemical Society, Journal,* v. 81, May 5, 1959, p. 2266-2270.

10170 Preparation of Some Organosilanediols and Phenylsilanetriol by Direct Hydrolysis Using Aniline as Hydrogen Chloride Acceptor. Improved preparation of unstable silanols involving the hydrolysis of the corresponding chlorosilanes with the theoretical amount of water in ether in the presence of aniline as hydrogen chloride acceptor. ***Toshio Takiguchi.*** *American Chemical Society, Journal,* v. 81, May 20, 1959, p. 2359-2361.

10171 Reactions of Furan Compounds. XVI. Conversion of Tetrahydro-2-methylenefuran Successively Into Dihydromethylfuran, Cyclopropyl Methyl Ketone and Methyl Propenyl Ketone by Heat. XVII. Pyrolysis of Tetrahydrofurfuryl Esters to Methyl Propenyl Ketone. XVI. ***Dorothy M. Aten Armitage and Christopher L. Wilson.*** XVII. ***George J. Baumgartner and Christopher L. Wilson.*** *American Chemical Society, Journal,* v. 81, May 20, 1959, p. 2437-2442.

10172 Studies in Purine Chemistry. II. A Facile Synthesis of 2-Substituted-Adenines. ***Edward C. Taylor, O. Vogl, and C. C. Cheng.*** *American Chemical Society, Journal,* v. 81, May 20, 1959, p. 2442-2448.

10173 Pteridines. XVII. Reactions of 2,4,6,7-Tetrachloropteridine. The Synthesis of 5,6,7,8-Tetrahydropteridine. XVIII. A Direct Synthesis of 2-Aminopyrazine-3-carboxamides. XIX. A Synthesis of 8-Substituted Pteridine-6-carboxylic Acids. XX. 3-Amino-4-(3*H*)pteridinone. XVII. ***Edward C. Taylor and William R. Sherman.*** XVIII. ***O. Vogl and Edward C. Taylor.*** XIX. ***Edward C. Taylor and Harvey M. Loux.*** XX. ***Edward C. Taylor, O. Vogl, and Paula K. Loeffler.*** *American Chemical Society, Journal,* v. 81, May 20, 1959, p. 2464-2481.

10174 The Stereochemistry of Reserpine, Deserpidine and Related Alkaloids. Chemical and physical data are presented which allow the rigorous assignment of stereoformulas to the alkaloids reserpine and deserpidine. ***Paul E. Aldrich et al.*** *American Chemical Society, Journal,* v. 81, May 20, 1959, p. 2481-2494.

10175 The Preparation and Reactions of 1-Cyanoformamide. Physical and toxicological properties are also presented. ***Richard P. Welcher, Mary E. Castellion, and V. P. Wystrach.*** *American Chemical Society, Journal,* v. 81, May 20, 1959, p. 2541-2547.

10176 Ketene Acetals. XXXVII. Cyclopropanone Acetals From Ketene Acetals and Carbenes. ***S. M. McElvain and Philip L. Weyna.*** *American Chemical Society, Journal,* v. 81, May 20, 1959, p. 2579-2588.

10177 Metal Complexes of Purine and Some of Its Derivatives. Acid dissociation constants of purine and some of its derivatives were investigated and the reactions between these purines and certain divalent metal ions are described. ***Graeme E. Cheney, Henry Freiser, and Quintus Fernando.*** *American Chemical Society, Journal,* v. 81, June 5, 1959, p. 2611-2615.

10178 Epoxyorganosiloxanes. Methods for preparing epoxy Si compounds in which the epoxy-containing group is attached to Si by a stable Si-C linkage. ***E. P. Plueddemann and G. Fanger.*** *American Chemical Society, Journal,* v. 81, June 5, 1959, p. 2632-2635.

10179 The Synthesis and Polymerization of 1,1,2,3-Tetrafluoro-1,3-butadiene. ***H. Iserson, M. Hauptschein, and F. E. Lawlor.*** *American Chemical Society, Journal,* v. 81, June 5, 1959, p. 2676-2677.

10180 Chemistry of Cyclobutanes. I. Synthesis of Methylenecyclobutanes. Synthesis involves cycloaddition to allenes to appropriately substituted olefins. ***H. N. Cripps, J. K. Williams, and W. H. Sharkey.*** *American Chemical Society, Journal,* v. 81, June 5, 1959, p. 2723-2728.

10181 Studies in Stereochemistry. XXIX. Neighboring Hydrogen Participation in Ionization to Give Ethylene Protonium Ions as Intermediates in the Wagner-Meerwein Rearrangement. XXX. Models for Steric Control of Asymmetric Induction. XXXI. Conformation, Configuration and Physical Properties of Open-Chain Diastereomers. XXIX. ***Donald J. Cram and Jack Tadanier.*** XXX. ***Donald J. Cram and Karl R. Kopecky.*** XXXI. ***José Luis Mateos and Donald J. Cram.*** *American Chemical Society, Journal,* v. 81, June 5, 1959, p. 2737-2762.

10182 Proton N.S.R. Spectroscopy. V. Studies of Amino Acids and Peptides in Trifluoroacetic Acid. Proton spin resonance spectra of trifluoroacetic acid solutions of all the common and several less common amino acids and of many of their glycyl peptides and N-acetyl derivatives. ***F. A. Bovey and G. V. D. Tiers.*** *American Chemical Society, Journal,* v. 81, June 5, 1959, p. 2870-2878.

10183 On the Trityl Method for Peptide Synthesis. Trityl derivatives of amino acids can be isolated by chloroform extraction of their diethylammonium salts from the tritylation reaction mixture. ***Gerassimos C. Stelakatos, Dimitrios M. Theodoropoulos, and Leonidas Zervas.*** *American Chemical Society, Journal,* v. 81, June 5, 1959, p. 2884-2887.

10184 Stability and Synthesis of Phenylboronic Acids. Preparation of several substituted carboxyphenylboronic acids. Carbon-boron bonds in such compounds have marked stability. ***A. H. Soloway.*** *American Chemical Society, Journal,* v. 81, June 20, 1959, p. 3017-3019.

10185 Nitrogen Mustard Derivatives Containing the Phosphonate Group. ***Fred Kagan, Robert D. Birkenmeyer, and Richard E. Strube.*** *American Chemical Society, Journal,* v. 81, June 20, 1959, p. 3026-3031 .

10186 6-Thiouric Acid—a Metabolite of 6-Mercaptopurine. 6-Thiouric acid synthesized by the direct thiation of uric acid. Its structure was established by comparison with the isomeric 2- and 8-thiouric acids synthesized unequivocally. ***Ti Li Loo, Marvin E. Michael, Arthur J. Garceau, and James C. Reid.*** *American Chemical Society, Journal,* v. 81, June 20, 1959, p. 3039-3041.

10187 Potential Anticancer Agents. XVIII. Synthesis of Substituted 4,5-Trimethylenepyrimidines. ***Leonard O. Ross, Leon Goodman, and B. R. Baker.*** *American Chemical Society, Journal,* v. 81, June 20, 1959, p. 3108-3114.

10188* Thermal Oxidation of Methyl Esters of Fatty Acids. Methyl esters of lauric, stearic, and oleic acids were oxidized in the presence of O for various intervals of time. Decomposition products and the residual materials were subjected to chemical analysis in order to gain an insight into the mechanism of oxidation. ***Venkatachalam Ramanathan, Taketami Sakuragi, and F. A. Kummerow.*** *American Oil Chemists' Society, Journal,* v. 36, June 1959, p. 244-248.

10189* New Kinds of Hydrazines With Basic Substituents and Their Application in the Synthesis of Pharmaceuticals. New hydrazines differ from the hitherto known hydrazine derivates in that their molecules possess in addition to their hydrazine function a further grouping with basic N. These hydrazines were converted to various physiologically active heterocyclic systems, as pyrazolones, pyridazones, 3,5-pyrazoli-

dinediones, and azetidine-2,4-diones. (*In German.*) Neuartige, basisch substituierte Hydrazine und ihre Anwendung in der Arzneimittelsynthese. ***E. Jucker.*** *Angewandte Chemie*, v. 71, no. 10, May 21, 1959, p. 321-333.

10190* Pentalene Synthesis Tests. Starting from Schroeter-Vossen's diketone I, hexacyclic and octacyclic diketones were obtained by condensation with *o*-phthaldialdehyde and naphthalene dialdehyde-(2,3); they could not be isomerized into the corresponding hydroxypentalenes. (*In German.*) Versuche zur Synthese von Pentalenen. ***Wilhelm Treibs and Siegfried Hauptmann.*** *Annalen der Chemie (Justus Liebigs)*, v. 622, nos. 1-3, 1959, p. 74-78.

10191* Synthesis of the *cis- and trans*-Isomers of *erythro*-2,4,6-Trimethyl-$\Delta^{2,3}$-tetracosenoic Acid. ***Lars Ahlquist, Cecile Asselineau, Jean Asselineau, Stina Ställberg-Stenhagen, and Einar Stenhagen.*** *Arkiv för Kemi*, v. 13, no. 6, 1959, p. 543-582.

10192* Summary of 159 Hydrocarbons Isolated From One Representative Petroleum. ***Frederick D. Rossini and Beveridge J. Mair.*** Paper from "Chemical & Engineering Data Series", v. 3, no. 1, p. 141-145, Apr. 1958. American Chemical Society, Washington, D. C. (QD501 In3c Ref.)

10193* Esters of Aromatic Alcohols and Dibasic Acids as Base Stocks for Nonspreading Oil Compositions. ***Seymour Portnoy, Frank D. Verderame, Joseph Messina, and Henry Gisser.*** Paper from "Chemical & Engineering Data Series", v. 3, no. 2, p. 287-293, Oct. 1958. American Chemical Society, Washington, D. C. (QD501 In3c Ref.)

10194* Preparation and Properties of Some Organophosphorus Compounds. ***L. L. Burger and R. M. Wagner.*** Paper from "Chemical & Engineering Data Series", v. 3, no. 2, p. 310-313, Oct. 1958. American Chemical Society, Washington, D. C. (QD501 In3c Ref.)

10195 The Interaction of Decalin and Friedel-Crafts Acetylating Agent. ***G. Baddeley and E. Wrench.*** *Chemical Society, Journal*, 1959, Apr., p. 1324-1327.

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See also: **10591** (α-benzildioxime).

CHEMISTRY—PHYSICAL

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10281 Van Slyke Factors for Hydrogen, Oxygen, Carbon Dioxide, and Carbon Monoxide. Tables of data calculated on an IBM 610 automatic computer are given to convert the measured pressure differences in the Van Slyke gas analysis apparatus into micromolar concentration of gas in solution for H, O, CO_2, and CO in water. ***G. E. Adams and A. R. Anderson.*** *U. S. Atomic Energy Commission, ANL-5991*, Apr. 1959, 7 pp. (UF767 Un3.1an Contin.)

10282 A Rationalization of the Formation of Saline and Metallic Hydrides. Energetics of the formation of saline and metallic hydrides are rationalized on the basis of more accurate values for the lattice energy. ***Thomas R. P. Gibb, Jr.*** *U. S. Atomic Energy Commission, NYO-7548*, Jan. 19, 1959, 30 pp. (UF767 U3my Contin.)

10283 The Non-Stoichiometry of Lanthanum Hydride. Interpretation of the thermal expansion data of the La-H system, obtained from a high temperature X-ray diffraction study with the specimen under hydrogen gas pressure, indicates that the hydride exists as a non-stoichiometric compound at elevated temperatures. ***Edward J. Goon.*** *U. S. Atomic Energy Commission, NYO-7549*, Mar. 30, 1959, 18 pp. (UF767 U3ny Contin.)

10284 Constitution of the Vapor and Vapor Pressure of SrO. High temperature vaporization data of SrO are reviewed. ***L. Brewer and J. Drowart.*** *U. S. Atomic Energy Commission, UCRL-8686*, Apr. 1959, 8 pp. (UF767 U3u Contin.)

10285 Free Energy Functions for Gaseous Monoxides. Free energy functions for gaseous monoxides have been calculated from presently available spectroscopic results. ***L. Brewer and M. S. Chandrasekharaiah.*** *U. S. Atomic Energy Commission, UCRL-8713*, Apr. 1959, 17 pp. (UF767 U3u Contin.)

10286 Indirect Action of Ionizing Radiation on Some Organic Compounds Containing the C-N Bond. Observations on the indirect action of ionizing radiation on compounds containing primary amine, secondary amine, N-alkylamide, and peptide-bond configurations are correlated in terms of related mechanisms involving the C-N linkage as the locus of chemical change. ***Warren M. Garrison.*** *U. S. Atomic Energy Commission, UCRL-8719*, Apr. 1959, 20 pp. (UF767 U3u Contin).

10287 Heat and Free Energy of Formation Data for Crystalline Cadmium and Lead Metasilicates. ***R. Barany.*** *U. S. Bureau of Mines Report of Investigations* 5466, 1959, 7 pp. (TN21 Un3r Vis.)

10288 Thermodynamics of Rare-Earth Compounds. Literature surveyed and values recalculated for the heats and free energies of formation of solid rare-earth compounds at 298 K. ***R. L. Montgomery.*** *U. S. Bureau of Mines Report of Investigations* 5468, 1959, 23 pp. (TN21 Un3r Vis.)

COATINGS

10289 Acrylic Resin Insulation. Acrylic resin coated magnet wire has excellent physical, chemical, and mechanical properties. Experimental and practical data on resistance to Refrigerant-22 indicate that acrylic resin insulation may be used in hermetic motors under more stringent conditions than present insulations. ***Fred J. Emig and Orville J. Spawn.*** *ASHRAE Journal*, v. 1, June 1959, p. 41 + 3 pages.

10290 Ceramic-Coated Copper Wire. The development of a ceramic coating for Cu wire is described. The coating is a special porcelain enamel, applied in a continuous process. The coated wire was evaluated using adaptations of the methods standard in the industry for insulated wire. Ceramic-coated wire produced on a pilot-plant scale was used successfully to wind specialty transformers and fractional-horse-power motors. ***Burnham W. King, George D. Kelly, Winston H. Duckworth, and Jack H. Terry.*** *American Ceramic Society Bulletin*, v. 38, May 1959, p. 251-255.

10291 Electrophoresis—A New Coating Tool. By applying electrophoretic deposition, metals, alloys, cermets, and solid lubricants can be bonded to virtually any metal with minute control of thickness, absolute uniformity, and low power consumption. ***Robert A. Keeler and Louis C. Terminello.*** *American Machinist*, v. 103, May 18, 1959, p. 138-139.

10292 Why and How Do You Use Hydrocarbon Solvents in Protective Coatings? *Thomas Barker.* *American Paint Journal*, v. 43, June 1, 1959, p. 72 + 12 pages.

10293 Foil and Paper Laminates. Outlines defects that may occur in paper for lamination to Al foil, sodium silicate being recommended as an adhesive when chloride and moisture contents are high. Discusses effect of paper thickness and of design on the moisture permeability of heat seal packs. ***T. H. Angel.*** *British Paper and Board Makers' Association, (Inc.), Proceedings of the Technical Section*, v. 40, pt. 1, Feb. 1959, p. 87-94. (TS1080 P19p Vis.)

10294 Chromizing of Steel. Describes a process of extreme simplicity and cheapness. ***José Sáenz Insausti.*** *Henry Brutcher Translation No.* 4553, 14 pp. (From *Instituto del Hierro* y del Acero, v. 9, no. 44, Mar. 1956, p. 250-257.) Henry Brutcher, Altadena, Calif.

10295 Evaluating the Economy of Reconditioning and Coating Underground Steel Pipe. By carefully selecting pipe for reconditioning, and accurately determining the time required for spot welding, the cost per foot for reconditioning an underground bare steel gas pipe line can be predicted. A method is developed to show the economy of the total operation ***George M. Pemberton.*** *Corrosion*, v. 15, May 1959, p. 75-77.

10296 High Temperature, High Pressure Testing of Organic Coatings for Oil and Gas Well Tubing. Conditions to be considered in formulating a suitable organic coating for inhole tubular goods. Laboratory testing methods to simulate actual operation conditions are discussed. *Corrosion*, v. 15, May 1959, p. 121 + 2 pages.

10297 Coatings for Offshore Drilling Structures. Corrosion conditions in the tidal area and splash zone of offshore platforms are discussed with the characteristics needed for a coating to be an effective means of corrosion control. Seven coatings and four composite coatings are presented with their characteristic properties and results. *Corrosion*, v. 15, May 1959, p. 131-132.

10298 Acetylenic Alcohol-Inhibited Pickling Bath as a Pretreatment Prior to Lining Steel Pipe. Acetylenic alcohols as inhibitors provide a substrate which will increase the corrosion inhibition of epoxy-phenolic systems under extreme immersion conditions. This substrate under test conditions provided protection equal, or superior to that provided by lightweight zinc phosphate pretreatment. ***K. N. Edwards, L. J. Nowacki, and E. R. Mueller.*** *Corrosion*, v. 15, May 1959, p. 275-278.

10299* The Present Situation of Hot Galvanizing. Studies importance of hot galvanizing due to the progress in industrial techniques and scientific information concerning the phenomena occurring during this process, investigations on the behavior in the presence of corrosion and financial advantages coming from hot galvanizing. (*In French.*) La situation actuelle de la galvanisation à chaud. ***R. Haarmann.*** *Corrosion et Anticorrosion*, v. 7, no. 4, Apr. 1959, p. 146-152.

10300 Preparatory Treatments for Protective Coatings. II. Degreasing and Pickling. *Corrosion Prevention & Control*, v. 6, Apr. 1959, p. 52-56.

10301 Clad Metals. In circumstances where it is not possible to modify chemical conditions to minimize corrosion, it is possible to achieve a degree of control by the application of coatings of more corrosion resistant metals. One type is the homogeneously bonded metallic type of coating. ***J. Erskine.*** *Corrosion Prevention & Control*, v. 6, Apr. 1959, p. 57-60.

10302* Electrostatic Flocking Gives Adherent Fibre Coatings. *Industrial Finishing (London)*, v. 11, May 1959, p. 44.

10303 Use of the Plasma Arc Torch for Applying Refractory Materials. Production applications of the plasma arc torch for fabricating parts and applying coatings that will withstand temperatures in excess of 5,000 F have been reported by the Linde Co., Division of Union Carbide Corporation, New York. *Machinery (London)*, v. 94, Apr. 29, 1959, p. 963-964.

10304 Strippable Coatings. Keep products bright, clean, safe during manufacture, handling, shipping, and storage. Properties of the most popular coatings; how and where they are used. ***Robert J. Fabian.*** *Materials in Design Engineering*, v. 49, May 1959, p. 110-115.

10305 Russian Work With Induction Heated Metal Spraying Pistol High Frequency Metallizing. The main difference between this new process and other methods of metallizing is that high frequency induction heating is used for melting the metal. ***A. P. Vlasov.*** *Metal Industry*, v. 94, May 15, 1959, p. 391-393.

10306 Observations on the Process of Nickel Deposition by Thermal Decomposition of Nickel Carbonyl at Low Pressures. Details are given of variables controlling the process and properties of the coatings obtained, such as apperance, microstructure, micro-hardness, and ductility. The adhesion and porosity of the coatings on various metallic bases are assessed and such factors as control of thickness and distribution on various shapes. The role of variables such as temperature, pressure, rate of flow and composition of vapor are discussed. ***L. W. Owen.*** *Metallurgia*, v. 59, May 1959, p. 227-233.

10307* Oxide Coating and Nitriding of Special Types of Steel in Nitrate-Nitrite Media. Formation of a very hard and corrosion-resisting film. The microhardness of the surface layer of treated specimens increases from 38 to 100%, as compared with that of untreated specimens. Production of nitride phases of undetermined composition when the specimens are subjected to a thermal treatment in nitrate nitric solutions of salts of alkali and alkali metals. (*In Russian.*) Oksidirovanie i azotirovanie spetsialnykh stalei v nitratnitritnykh sredakh. ***P. I. Protsenko and N. P. Popovskaia.*** *Nauchnye Doklady Vysshei Shkoly, Metallurgiia*, 1959, no. 1, p. 244-249.

10308* Minimum Paint Film Thickness for Economical Protection of Hot Rolled Steel Against Corrosion. Proceedings of the Paint Research Institute. ***Wouter Bosch.*** *Official Digest*, v. 31, May 1959, p. 602-609.

10309* Practical One-Package Urethane Coating Compositions. A new one-can urethane system which is a complete unit, requiring no catalyst or hardener, and which has excellent can stability in the absence of moisture. ***Ward J. Remington and Robert J. Athey.*** *Official Digest*, v. 31, May 1959, p. 612-623.

10310* Changes With Time in the Wash Primer WP-1 Composition. II. Variations in Chromium, Phosphate and Zinc Ions. *E. R. Allen, Leo Ojakaar, Norman Hiller, and Fredi Jakob.* *Official Digest*, v. 31, May 1959, p. 629-645.

10311* Exposure of Exterior House Paints. A method of exposure for weathering, covering preparation of the paints, selection of panels, application of the paints, exposure of the panels, and reading, recording, and reporting the results. ***Ward A. Southard.*** *Official Digest*, v. 31, May 1959, p. 646-662.

10312* Generations of Oils, Resins, and Polymers. A biography of the coatings family. ***Wilbur L. Boyer.*** *Official Digest*, v. 31, May 1959, p. 663-685.

10313* Polyester Coating Materials for Baking Industrial Finishes. A description of uses, characteristics, capabilities, and formulations of polyester coatings. *Paint Industry Magazine*, v. 74, May 1959, p. 7 + 2 pages.

10314* Low Odor Multicolor Paints. Different types of multicolor paints, their characteristics and formula suggestions are described. ***Paul Talley.*** *Paint Industry Magazine*, v. 74, May 1959, p. 10 + 3 pages.

10315 Fire-Retardant Paints and the Thermal Insulation (Industrial Buildings) Act. Presents opportunities and problems to the paintmaker. ***H. Lundy.*** *Paint Technology*, v. 23, May 1959, p. 165-167.

10316* New Specially Tailored Coating Latex. New high-shear viscometer has led to a controlled rheology latex–key to higher solids formulations. ***Harry Lowell.*** *Paper Trade Journal*, v. 143, May 25, 1959, p. 32-34.

10317 Thicker Coatings Add New Dimension to Markets for Vacuum Metallizers. New technique deposits up to 0.004 in. of Al or Cd on a wide variety of metals. Coating is tough, ductile, and resists corrosion. It can be anodized, colored, buffed. *Steel*, v. 144, June 1, 1959, p. 96-97.

10318* The Structure and Density of Iron Films Formed by Thermal Evaporation. The densities have been determined of Fe films of thickness 800-1600 Å. deposited on the cleavage faces of rocksalt crystals maintained at 470 C. The films are monocrystalline, as shown by electron diffraction, and appear continuous when examined in the electron microscope. Densities do not differ significantly from that for the bulk metal. ***O. S. Heavens, M. M. Brown, and V. Hinton.*** *Vacuum*, v. 9, no. 1, Mar. 1959, p. 17-20.

10319* Adhesion of Evaporated Metal Films. Test was developed to study vacuum-deposited Al films on glass surfaces by measuring the electrical resistance of the metal film during abrasion by a stream of fine SiC particles. ***F. Schossberger and K. D. Franson.*** *Vacuum*, v. 9, no. 1, Mar. 1959, p. 28-35.

See also: **10605** (determination of particle size of pigment grade Al powder).

CONTROL SYSTEMS, COMPUTERS, AND SYSTEMS ENGINEERING

10320* Techniques. Error Analysis in Floating Point Arithmetic. Since a normalized floating point procedure will always give a better result than a significant procedure (although the end result will give no indication of how much better), the latter argument about power series appears to hold for either machine arithmetic. ***John W. Carr III.*** *Association for Computing Machinery, Communications*, v. 2, May 1959, p. 10-15.

10321* Scientific and Business Applications. Survey of Progress and Trend of Development and Use of Automatic Data Processing in Business and Management Control Systems of the Federal Government, as of December 1957. II. The survey findings relate only to the use of electronic data processing in the business data and management control systems of the U. S. Government. *Association for Computing Machinery, Communications*, v. 2, May 1959, p. 17-20.

10322* Superconducting Computer Devices. Discusses the use of the superconductivity phenomenon for cheaper and faster bi-stable devices for use in computers. The most promising storage element appears to be an annular film of vacuum-deposited metal known as the Crowe element. ***J. M. Lock.*** *Automation Progress*, v. 4, May 1959, p. 162-165.

10323 Superconducting Computer Elements. A survey is made of the present status of superconducting circuit components, including both active elements of the "cryotron" type and passive elements such as persistent current memory cells. The factors which affect the speed of operation of these devices are discussed. ***E. H. Rhoderick.*** *British Journal of Applied Physics*, v. 10, May 1959, p. 193-198.

10324 Computer Techniques in Chemical Engineering. Presents twelve papers on three computation techniques for solving chemical engineering problems. One paper discusses a graphical method of making distillation calculations and one an analogue method. ***F. J. Van Antwerpen, editor.*** 92 pp. 1959. American Institute of Chemical Engineers, New York. (TP168 Am35c Over.)

10325* On Computing Errors of an Integrator for a Slow Type Electronic Analog Computer. The various causes of computing errors as well as their effects in integrators of slow type analog computers are examined. ***T. Miura, Z. Abe, and M. Nagata.*** *ETJ of Japan*, v. 4, no. 3, Sept. 1958, p. 81-85.

10326* Automatic Control System Design. III. Frequency Response and Transfer Functions. The transfer function of a device is an algebraic expression of the ratio of the output to the input (the gain of the device) in concise form. It is developed, using Laplace operational techniques, from the device's frequency response. ***Ira Ritow.*** *Electrical Manufacturing*, v. 63, June 1959, p. 129-135.

10327* Transistorized Pulse Amplifier. The article describes the design of a transistorized pulse amplifier for use with diode logic circuits. With an effective over-all gain exceeding 10, the total rise- and fall-times obtainable are each better than 0.05 microsecond, although there is also a short delay between the input and output pulses. ***J. N. Barry and D. M. Leakey.*** *Electronic & Radio Engineer*, v. 36, June 1959, p. 200-207.

10328 Using Thin Films in High-Speed Memories. A brief general description of the operating principles and circuits using thin magnetic films in high-speed memories operating in millimicrosecond range. ***Eric E. Bittmann.*** *Electronics*, v. 32, no. 23, June 5, 1959, p. 55-57.

10329 Sending Digital Data Over Narrow-Band Lines. Describes a transistorized wire-line terminal unit which transmits and receives binary data at up to 2,500 bits/sec. in a nominal 3-kc voice-band circuit. Amplitude-modulation system uses vestigial sideband transmission and synchronous operation. ***J. L. Hollis.*** *Electronics*, v. 32, no. 23, June 5, 1959, p. 72-74.

10330 Sequential Transducer Issue. *IRE Transactions on Circuit Theory*, v. CT-6, no. 1, Mar. 1959, 139 pp. (TK1 In6.6c Vis.)

10331 A Generalized Resistor-Transistor Logic Circuit and Some Applications. Several practical circuits are worked out, including a two-transistor binary full adder, a three-transistor comparator and a one-transistor-per-bit-ring counter. They can be incorporated with other circuits to simplify a digital system. ***S. C. Chao.*** *IRE Transactions on Electronic Computers*, v. EC-8, no. 1, Mar. 1959, p. 8-12. (TK1 In6.6e Vis.)

10332 A Synthesis Technique for Minimal State Sequential Machines. A method is presented which always yields a minimal state sequential machine satisfying a prescribed finite set of input-output sequences. ***Seymour Ginsburg.*** *IRE Transactions on Electronic Computers*, v. EC-8, no. 1, Mar. 1959, p. 13-24. (TK1 In6.6e Vis.)

10333 A Ring Model for the Study of Multiplication for Complement Codes. A model is presented which, when modulo addition is used, can be used to derive multiplication correction schemata for operands expressed in either the radix complement or the diminished radix complement code. ***Harvey L. Garner.*** *IRE Transactions on Electronic Computers*, v. EC-8, no. 1, Mar. 1959, p. 25-30. (TK1 In6.6e Vis.)

10334 A High-Speed Analog to Digital Converter. An electronic voltage encoder has been developed which converts analog voltages to their corresponding parallel seven binary-digit representations at a 50-kc encoding rate. The encoder is capable of being time-shared by any number of 0-50-volt range inputs. ***Donald Savitt.*** *IRE Transactions on Electronic Computers*, v. EC-8, no. 1, Mar. 1959, p. 31-35. (TK1 In6.6e Vis.)

10335 Time Multiplexing as Applied to Analog Computation. This multiplexer can perform a common dynamic operation upon several sets of inputs utilizing equipment for one dynamic operation. The results of the multiplexing will yield the corresponding several sets of outputs as though each set of inputs were operated upon separately by the dynamic operation. ***Eugene Rawdin.*** *IRE Transactions on Electronic Computers*, v. EC-8, no. 1, Mar. 1959, p. 42-47. (TK1 In6.6e Vis.)

10336 A Figure of Merit for Single-Pass Data Recording Systems. The problem of the interference caused by eddy current transients to the reproduction of recorded data is studied for single-pass magnetic recording systems of both the write-read and read-write variety. ***J. H. Mulligan, Jr.*** *IRE Transactions on Electronic Computers*, v. EC-8, no. 1, Mar. 1959, p. 48-54. (TK1 In6.6e Vis.)

10337 Simulation to Obtain a Systems Measure of an Air Duel Environment. A combined analog-digital simulation of an air battle between an attacking bomber aircraft and a ground controlled interceptor, including the intermediate human radar operator, has been designed for the purpose of evaluating the effects of airborne electronic countermeasures upon a ground-based radar operator. ***A. A. B. Pritsker, R. C. Van Buskirk, and J. K. Wetherbee.*** *IRE Transactions on Electronic Computers*, v. EC-8, no. 1, Mar. 1959, p. 55-59. (TK1 In6.6e Vis.)

10338 Abstracts of Current Computer Literature. (August, September, and October, 1958). Presents abstracts about equipment, systems, automata, programs, mathematics-logic, personnel, bibliographies, biographies, standards, summaries and reviews. Subject and author indexes. *IRE Transactions on Electronic Computers*, v. EC-8, no. 1, Mar. 1959, p. 69-82. (TK1 In6.6e Vis.)

10339* On the Statistical Studies of Response of Automatic Control Systems With a Non-Linear Element of Zero-Memory Type. II. Statistical Evaluation of Response of Servosystems With a Non-Linear Element of Zero-Memory Type to a Sinusoidal Signal and a Gaussian Disturbance. ***Yoshikazu Sawaragi and Yoshifumi Sunahara.*** *Kyoto University, Engineering Research Institute, Technical Reports*, no. 50, Dec. 1958, 24 pp.

10340* The Statistical Studies on the Response of Automatic Control Systems With a Non-Linear Element of Zero-Memory Type. An extensive theoretical study of the response of non-linear control systems is presented. Some experimental results are also given. ***Yoshikazu Sawaragi and Yoshifumi Sunahara.*** *Kyoto University, Engineering Research Institute, Technical Reports*, no. 57, Mar. 1959, 20 pp.

10341 Classification and Minimization of Switching Functions. Electronic computers consist of a large number of switching elements, of which there are relatively few types, which together are capable of handling or forming a large number of conditions. A special switching technique, with the aid of diodes, is now being used for those parts of the machine where extremely short switching times are required. ***N. C. de Troye.*** *Philips Research Reports*, v. 14, no. 2, Apr. 1959, p. 151-193.

10342* A Simplified Theory of Feedback Control Systems. II. Since all control systems exhibit more or less pronounced non-linearities, it is now time that we should turn to the more elementary aspects of the theory of nonlinear systems. We shall limit ourselves to the study of systems comprising one non-linear element, the behavior of which can be described by a nonlinear relationship between one input and one output variable. ***P. Naslin.*** *Process Control and Automation*, v. 6, May 1959, p. 206-209.

10343 PUBCO-I, an IBM 704 Code for Computing the Ideal Thermodynamic Functions of a Polyatomic Gas Molecule. The equations used to describe the thermodynamic functions in the two treatments are discussed. General description of code is presented and complete IBM listing for code is given. Sample computations of ideal thermodynamic functions of HCN are given for both the RRHO molecule and the NRRAO molecule. ***Lawrence R. Sitney.*** *U. S. Atomic Energy Commission, LA-2278*, May 8, 1959, 52 pp. (UF767 U3La Contin.)

10344 FLIP—An IBM-704 Code to Solve the P_L and Double-P_L Equations in Slab Geometry. FLIP, a reactor design code for the IBM-704 computer, uses the P_L and double-P_L approximations to solve the one-velocity, one-dimensional transport equation in slab geometry. The following approximations are available in FLIP: P_3, P_5, P_7, double-P_1, double-P_2, and double-P_3. ***B. L. Anderson, J. A. Davis, E. M. Gelbard, and P. H. Jarvis.*** *U. S. Atomic Energy Commission, WAPD-TM-134*, Mar. 1959, 30 pp. (UF767 Un3.1wa Contin.)

See also: **10931** (assembly line scheduling).

ELECTRICAL ENGINEERING

10345 Electric Motors and Generators Illustrated. The purpose of this book is to provide such understanding for those outside electrical engineering, as well as a useful survey for those professionally interested. Avoiding difficult electrical theory and mathematics as far as possible, it describes all types of D.C. and A.C. motors and generators: their design, construction, installation, operation, testing, and maintenance. ***E. T. G. Emery, et al.*** 384 pp. 1959. Philosophical Library, New York. (TK2411 Em36e)

10346 An Investigation on Elastic Sheath Pressure Cables. An investigation conducted on cables with elastically deforming sheaths, which have been designed to dispense with the conventional bulky and expensive external means of maintaining pressure in high-pressure cables, has shown that satisfactory performance may be expected from these elastic sheath cables. ***V. Klein.*** *Electrical Engineering*, v. 78, June 1959, p. 638-639.

10347* Circuit Factors in Motor Protection. For efficient and reliable machine and equipment performance, an essential but often complex task is the proper selection and specification of overload and short-circuit protective devices. The entire circuit and all associated equipment must be analyzed to achieve effective protection. ***H. J. Wilt.*** *Electrical Manufacturing*, v. 63, June 1959, p. 66-73.

10348* New Circuits for Better Diode Measurements. Describes the equipment used and the results obtained in precision measurement of recovery time, static characteristics, and capacitance of semiconductor diodes. ***Fred E. Dickey.*** *Electronic Design*, v. 7, no. 3, Feb. 4, 1959, p. 18-21.

10349 Transistor Circuits for Power-Line Carrier. Describes transistorized carrier-current transmitter and receiver which uses 200-cps channel bandwidth and 500-cps channel spacing to fit more channels into power-line carrier spectrum. ***Keith Stenerson.*** *Electronics*, v. 32, no. 20, May 15, 1959, p. 70-72.

10350 High-Speed Readout for Data Processing. Describes operating principles and performance of input tape pulses teletype-writer print heads which charge surface of paper. Powdered ink adheres to paper, forming 3,000 words/min. ***Ralph E. West.*** *Electronics*, v. 32, no. 22, May 29, 1959, p. 83-85.

10351* A New Stage in the Electrification of the U.S.S.R. Describes the main trends in the 7-year plan of the electrification of the U.S.S.R. as envisaged by the 21st Congress of the CPSS. (*In Russian.*) Novyĭ etap elektrifikatsii SSSR. ***V. I. Veits and V. I. Denisov.*** *Elektrichestvo*, 1959, no. 4, Apr. p. 1-8.

10352 Some Problems in Ionic Propulsion Systems. Some of the problems and applications of ionic propulsion systems are discussed. Three different systems' optimization criteria are considered: the maximization of the initial acceleration of a space vehicle; the minimization of the total-mass-to-payload-mass ratio; and the minimization of the propellant mass required to refuel the vehicle. ***E. Stuhlinger and R. Seitz.*** *IRE Transactions on Military Electronics*, v. MIL-3, no. 2, Apr. 1959, p. 27-33.

10353 Plasma Propulsion Devices for Space Flight. An analysis of some of the more immediate space missions indicates that a large increase in payload can be achieved when electrical propulsion is used instead of chemical propulsion. For missions in the gravitational field of the Earth and to the Moon, the optimum specific impulse range for electrical propulsion is from about 1500 to 5000 seconds. ***M. Camac, A. Kantrowitz, and H. E. Petschek.*** *IRE Transactions on Military Electronics*, v. MIL-3, no. 2, Apr. 1959, p. 34-41.

10354 Plasma Propulsion Possibilities. Plasma propulsion systems are arranged in three categories according to the cyclic nature of the jet produced: (1) steady, (2) alternating or wave-accelerated, and (3) pulsed. Typical systems within each category are described. ***Warren Rayle.*** *IRE Transactions on Military Electronics*, v. MIL-3, no. 2, Apr. 1959, p. 42-45.

10355 A Bias Function Generator for the Zero Gradient Synchrotron. An Analog function generator producing a biasing current for the permeability-tuned master oscillator of

the zero gradient synchrotron is described. It is found that an integrator with a precision of ± 0.01% can be built, which will result in a considerable simplification of read-out devices and the bias generator system. ***L. K. Wadhwa.*** *IRE Transactions on Nuclear Science*, v. NS-6, no. 1, Mar. 1959, p. 2-11. (TK1 In6.6ns Vis.)

10356 Servologarithmic Amplifier for Reactor Instrumentation. The instrument described is a servo which provides an output proportional to the logarithm of the input over 4 decades. Use of a special four-decade exponential feedback potentiometer makes the accuracy and repeatability much better than that obtainable with the usual logarithmic amplifiers. ***W. J. Hartin.*** *IRE Transactions on Nuclear Science*, v. NS-6, no. 1, Mar. 1959, p. 11-14. (TK1 In6.6ns Vis.)

10357 Study of the Feasibility of a Ferrite Modulation System for an FM Cyclotron. Presents analysis of a ferrite modulation system for a synchrocyclotron. Analysis is performed by numerical computation and is substantiated by a scaled experiment. Extensive data is obtained from the computation and is available in microfilm form. The computer program is listed. ***Kurt Enslein.*** *IRE Transactions on Nuclear Science*, v. NS-6, no. 1, Mar. 1959, p. 14-25. (TK1 In6.6ns Vis.)

10358 Nanosecond Pulse Transformers. Nanosecond pulse transformer is considered from point of view of transmission lines. Advantages achieved by this design approach are described. ***C. Norman Winningstad.*** *IRE Transactions on Nuclear Science*, v. NS-6, no. 1, Mar. 1959, p. 26-31. (TK1 In6.6ns Vis.)

10359 A Chronotron for Relativistic Neutron Time-of-Flight Measurements. Describes circuit and preliminary performance data for the chronotron assembled from standard counting units presently in use at UCRL. ***Robert H. Ragsdale and Warren Fenton Stubbins.*** *IRE Transactions on Nuclear Science*, v. NS-6, no. 1, Mar. 1959, p. 31-34. (TK1 In6.6ns Vis.)

10360 Ion Phase Measurement Techniques of the Birmingham Cyclotron. The experimental technique used for internal beam ion phase measurements on the Birmingham cyclotron is described. Ion phase measurements were carried out by measuring the target current waveform of a screened two-electrode target. Target current waveform was displayed on a cathode-ray-tube screen against sine of cyclotron RF phase or in polar coordinates. ***M. Konrad.*** *IRE Transactions on Nuclear Science*, v. NS-6, no. 1, Mar. 1959, p. 35-40. (TK1 In6.6ns Vis.)

10361* A Study of Ferromagnetic Domains in Perminvar Possessing a Rectangular Hysteresis Loop. A brief account is given of a series of investigations directed towards understanding the properties of the elementary domains in "Perminvar" and 65/35 Nickel-Iron, which acquire rectangular hysteresis loops after being annealed in a magnetic field. Investigations using the magnetic Kerr effect show that in a "demagnetized" state, annular rings of these materials contain annual domains about 1 mm. wide. Reversible permeability measurements indicate that the domain walls are very strongly held by internal forces. At high inductions magnetization takes place by radial movement of a single wall from the inner edge. ***E. W. Lee.*** *Journal de Physique et le Radium*, v. 20, nos. 2-3, Feb.-Mar. 1959, p. 109-112.

10362* Remanent Magnetization of Fine Particles. A brief review is given of some calculations of the remanent magnetization of fine particles. The remanence after previous saturation has been calculated for a number of different types of anisotropy. A discussion is also given of remanence curves attained after application of D.C. or A.C. fields, and relations between such curves are pointed out. ***E. P. Wohlfarth.*** *Journal de Physique et le Radium*, v. 20, nos. 2-3, Feb.-Mar. 1959, p. 295-297.

10363* New Experimental Results for Plasma Electron Oscillations. This paper contains an account of some experimental investigations of plasma electron oscillations in low-pressure mercury vapor discharges with plane oxide coated cathodes. The appearance of some of the discharges are described. ***D. W. Mahaffey.*** *Journal of Electronics and Control*, v. 6, no. 3, Mar. 1959, p. 193-203.

10364* The Space Charge Field Emission Hypothesis Applied to Hayashi Data on Discharges Through Gases. Previous experiments and studies led to the conclusion that electric discharges in air and in H are initiated by a space charge field together with an externally applied field. The sum of the two fields equals the emission field of the cathode material or that of a negative ion space charge. ***Herman Ritow.*** *Journal of Electronics and Control*, v. 6, no. 3, Mar. 1959, p. 236-245.

10365* Effects of Transposition, Branch and Other Transition Points Upon Surge Performances Along Over-Head Lines. The over-all characteristics of surge propagation on multi-conductor systems are considered, taking into account reflection phenomena at the particular transition points, such as transposition and branch points. ***Shigenori Hayashi, Yoshio Hattori, and Jurō Umoto.*** *Kyoto University, Engineering Research Institute, Technical Reports*, no. 52, Dec. 1958, 12 pp.

10366 The Electrical Industry as a Market for Aluminium. Forecasts an expanding future for aluminium in the electrical industry due to economic factors, surveys some aspects of the use of aluminium that have not been fully exploited and mentions some of the development work being undertaken by the Aluminium Limited group of companies. ***A. G. Thomas.*** *Light Metals*, v. 22, May 1959, p. 150 + 3 pages.

10367 Measurement of Electrical Waveforms of Low-Energy Spark Discharges. Describes circuit details of the assembled apparatus, performance characteristics of the complete system, and some preliminary data from representative self-initiated low-energy capacitance sparks used for the ignition of explosive-gas mixtures. ***Kenneth Lipman and Paul G. Guest.*** *U. S. Bureau of Mines Report of Investigations* 5460, 1959, 12 pp. (TN21 Un3r Vis.)

10368* Old and New Insulating Materials for Cables and Conductors. *Wire*, no. 40, Apr. 1959, p. 35-37.

ELECTROCHEMISTRY

10369 Analysis of Electroplating and Related Solutions. More manipulative detail is given than is usual in analytical text books. Methods which should not be beyond the capabilities of more foreman platers and the more intelligent operators are included. Over 300 methods for the determination of principal constituents and impurities are given. ***Kenneth E. Langford.*** 2nd Ed. 408 pp. 1958. Robert Draper Limited, England. (TS670 L26a2)

10370 Regeneration of Electrolytes for the Electropolishing of Carbon Steel. Study of processes occurring in electrolytic polishing of plain C steel in chromic acid solutions, with special reference to extent of the harm done by Fe(II) and Cr(III). ***T. Zak.*** *Henry Brutcher Translation No.* 4513. 9 pp. (From *Metalloberfläche*, v. 12, no. 12, 1958, p. 361-363.) Henry Brutcher, Altadena, Calif.

10371 Operating Large Aluminum Pots at Reynolds' Corpus Christi. ***James W. Franklin.*** *Engineering and Mining Journal*, v. 160, May 1959, p. 94-97.

10372 Thermoelectric Energy Conversion in Solids. There seems little doubt that the impact of thermoelectric methods in refrigeration, heating, power generation, and transportation will be felt with increasing force as time proceeds. Obviously, the commercial realization of the developments in this field depends vitally on vigorous research and development in solid state materials. ***Nicholas Fuschillo.*** *Franklin Institute, Journal*, v. 267, no. 5, May 1959, p. 443-452.

ELECTRONICS

10373* The Thermic Stability of Transistors Under Dynamic Conditions. The fact that transistors become thermally instable under certain external electrical conditions makes it desirable to know the criteria of such cases. This paper gives

a more general treatment for sine and pulse waveforms as driving signals, including as special cases the formulas for static conditions and disconnect phenomena, which had been known for some time already. (*In German.*) Die thermische Stabilität von Transistoren unter dynamischen Bedingungen. ***Fritz Weitzsch.*** *Archiv der Elektrischen Übertragung*, v. 13, May 1959, p. 185-198.

10374* Signal-to-Noise Problems and a New Equalization for Magnetic Recording of Music. Measuring procedures and specifications currently used in the sound recording industry are discussed. It is stated that any further improvement must be made by improving the utilization of the tape with respect to the characteristics of the tape, the music, and the ear. ***John G. McKnight.*** *Audio Engineering Society, Journal*, v. 7, no. 1, Jan. 1959, p. 5-12.

10375* A Wide-Range Electrostatic Loudspeaker. Theoretical considerations involved in the design of the experimental wide-range ELSU are discussed. It is stated that the present prototype described indicates that the electrostatic loudspeaker can serve as a wide-range sound source for high-quality sound-reproducing systems. ***Charles I. Malme.*** *Audio Engineering Society, Journal*, v. 7, no. 1, Jan. 1959, p. 47-54.

10376 Analysis of Phonon-Drag Thermomagnetic Effects in n-Type Germanium. Describes a study which has been made of the Nernst effect and the variation of thermoelectric power with magnetic field for single-crystal samples of n-type germanium of various orientations and impurity concentrations, at fields up to 18,000 gauss and temperatures from 275 to 60 K and below. ***C. Herring, T. H. Geballe, and J. E. Kunzler.*** *Bell System Technical Journal*, v. 38, no. 3, May 1959, p. 657-747.

10377 Analysis and Design of a Transistor Blocking Oscillator Including Inherent Nonlinearities. An analysis of transistor blocking oscillators is presented which differs significantly from previous approaches in that the nonlinear dependence of collector current and base voltage upon base current is considered. A design example in which the analysis is confirmed by experiment is given. ***J. A. Narud and M. R. Aaron.*** *Bell System Technical Journal*, v. 38, no. 3, May 1959, p. 785-852.

10378 Hall Effect Devices. Results of a survey of Hall effect devices are presented. Semiconductor materials are discussed in terms of what type of material is most desirable and how currently available materials limit the usefulness of Hall effect devices. ***W. J. Grubbs.*** *Bell System Technical Journal*, v. 38, no. 3, May 1959, p. 853-876.

10379* Recent Advances in Potted and Printed Circuits. The various potting resins are described in relation to the variation of properties with different proportions of hardener and the effects on the parameters of the potted components. The causes of failure of potted circuits are discussed. ***H. G. Manfield.*** *British Institution of Radio Engineers, Journal*, v. 19, May 1959, p. 289-302.

10380* Asymmetric Information Channels. The capacity of asymmetric channels has been studied in terms of the probability of the possible errors. The theory sheds interesting light on pulse code modulation using amplitude keying. ***R. B. Banerji.*** *British Institution of Radio Engineers, Journal*, v. 19, May 1959, p. 305-308.

10381* Low-Frequency Ripple Voltage of Small Convertors for Portable Radio Use. The results of the experimental measurement of the low-frequency ripple voltage of small convertors are described and compared with its theoretically calculated value. ***T. Horii.*** *ETJ of Japan*, v. 4, no. 3, Sept. 1958, p. 71-75.

10382* Characteristics of Solid Tantalum Capacitors. An evaluation of solid Ta capacitors for equipment design engineers is given. ***Albert Lunchick.*** *Electrical Manufacturing*, v. 63, June 1959, p. 74 + 4 pages.

10383* Pulse and Square-Wave Generators. Some basic circuits for generating rectangular pulses and square-waves are described and the performance obtainable is considered, with reference to commercially-available instruments. *Electronic & Radio Engineer*, v. 36, June 1959, p. 211-219.

10384* Design of "Optimum" Arrays for Direction-Finding. Considers the directional spectrum, the basic system, the action of a line array, the "optimum" system, some optimum arrays in one dimension and in two dimensions, synthesizing the power distribution, wide-band systems and super-directive arrays. ***N. F. Barber.*** *Electronic & Radio Engineer*, v. 36, June 1959, p. 222-232.

10385* Interconnecting Microminiature Modules. The authors discuss various methods of interconnecting modules without adding substantially to the total volume. ***Norman J. Doctor and Emma L. Hebb.*** *Electronic Design*, v. 7, no. 3, Feb. 4, 1959, p. 34-37.

10386* Fine Line Etched Wiring. Several processes for making fine etched lines are discussed. ***Edith Davies Olson.*** *Electronic Design*, v. 7, no. 3, Feb. 4, 1959, p. 38-41.

10387* Applying Vacuum Evaporation Techniques for Microminiaturization. Important characteristics of two-dimensional thin films are described and the problems in applying them to extremely thin wafers for getting minimum volume circuit are discussed. ***L. Harold Bullis and William E. Isler.*** *Electronic Design*, v. 7, no. 3, Feb. 4, 1959, p. 42-45.

10388* Transistorized Equipment Design. *Electronic Equipment Engineering*, v. 7, June 1959, p. 51-82.

10389 Theory and Use of Field-Effect Tetrodes. Discusses new kind of field-effect device which provides in a single unit characteristics previously unobtainable or else achievable only with extensive circuitry. ***H. A. Stone, Jr.*** *Electronics*, v. 32, no. 20, May 15, 1959, p. 66-68.

10390 Millimicrosecond Switching Diodes. Outdiffusion technique produced fast-switch diodes have switching times of 2 to 3 millimicroseconds, comparing favorably in speed with fast-switching transistors. Optimum diode-transistor combinations can be used. ***J. Halpern and R. H. Rediker.*** *Electronics*, v. 32, no. 23, June 5, 1959, p. 66-67.

10391 Tube-Transistor Hybrids Provide Design Economy. Design technique is described for combining transistors and vacuum tubes in a single circuit, resulting in reduction of power consumption, bulk and cost while improving reliability. ***G. A. Dunn and N. C. Hekimian.*** *Electronics*, v. 32, no. 23, June 5, 1959, p. 68-70.

10392 Switching VHF Power With Silicon Diodes. Silicon power rectifier diodes, placed in a coaxial cable, switch r-f power from one circuit to another. Configuration, designed for vhf antenna systems in fast aircraft, can be used in many applications and at lower frequencies. ***Roy H. Mattson and S. H. Liu.*** *Electronics*, v. 32, no. 25, June 19, 1959, p. 58-59.

10393 Voltage Tunable Millimeter-Wave Oscillators. Experimental backward-wave oscillator tubes for millimeter-wave generation can be tuned over wide frequency range by single voltage adjustment. Tubes utilize helix slow-wave structure wound with rectangular cross-section tape. ***D. J. Blattner and F. Sterzer.*** *Electronics*, v. 32, no. 25, June 19, 1959, p. 62-63.

10394 Frequency Shifts Improve Pulse Communications. New technique overcomes multipath problems in long-range pulse transmission. Transmitter and receiver simultaneously shift frequency so that receiver is sensitive only to the transmission arriving by the shortest path. ***J. L. Hollis.*** *Electronics*, v. 32, no. 25, June 19, 1959, p. 66-69.

10395 Circuit Design Using Magnetostrictive Filters. Designers of telemetry equipment, Doppler radar and computers are finding that magnetostrictive filters compare favorably with the crystal type, offer significant cost reduction. ***A. P. Thiele.*** *Electronics*, v. 32, no. 25, June 19, 1959, p. 72-74.

10396* Waveguide Filters With a Sheep Attenuation Characteristic. A limited number of filter circuits is realizable in the microwave range. The paper describes the most important elements of these circuits and provides application examples of these elements for filters in the 4000 megacycle frequency range. (*In German.*) Hohlleiterfilter mit versteilerter Dämpfungscharakteristik. ***F. Künemund.*** *Frequenz*, v. 13, Apr. 1959, p. 97-102.

10397* Frequency Modulation of a Transmitter by Changing the Inductance. Ferrites can be successfully used for the frequency modulation of small and control transmitters. (*In German.*) Frequenzmodulation eines Senders durch Induktivitätsänderung. ***W. Moortgat-Pick.*** *Frequenz*, v. 13, Apr. 1959, p. 117-120.

10398 Background and Principles of Tacan Data Link. Describes the Tacan data link, an automatic air-surface communication method necessary for providing one common air-navigation and air-traffic-control system resulting from the integration of Tacan with VOR. ***B. Alexander, R. C. Renick, and J. F. Sullivan.*** *IRE Transactions on Aeronautical and Navigational Electronics*, v. ANE-6, no. 1, Mar. 1959, p. 9-16. (TK1 In6.6a Vis.)

10399 The Gyrovibrator. A new device for measuring angular rate is analyzed and its mechanical and electrical design features presented. Only the theory of the device is presented here, along with the expected performance, since the developmental work is not yet at the stage where experimental results can be given. ***N. D. Diamantides.*** *IRE Transactions on Aeronautical and Navigational Electronics*, v. ANE-6, no. 1, Mar. 1959, p. 16-25. (TK1 In6.6a Vis.)

10400 Radar Performance Degradation in Fog and Rain. An equation is derived which can be used to compare the ability of a pulse radar to detect targets in rain and fog with its ability to detect similar targets in dry air. ***H. E. Hawkins and O. La Plant.*** *IRE Transactions on Aeronautical and Navigational Electronics*, v. ANE-6, no. 1, Mar. 1959, p. 26-30. (TK1 In6.6a Vis.)

10401 The PAR-Scope: An Oscilloscope Display for Weather Radars. Describes the PAR-scope, an oscilloscope display for pulsed radars whose display is a profile of average reflectivity. It is shown that reflectivity distributions of major interest can be easily represented to an accuracy within 1 db of that implicit in the radar calibration. ***Edwin Kessler, III.*** *IRE Transactions on Aeronautical and Navigational Electronics*, v. ANE-6, no. 1, Mar. 1959, p. 31-36. (TK1 In6.6a Vis.)

10402 A 215-Mile 2720-MC Radio Link. The results from the operation of a 215-mile, 2720-mc radio link are discussed. The link was operated for a period of twenty months. Pulse distortion and meteorological correlations are discussed qualitatively. ***L. H. Doherty and G. Neal.*** *IRE Transactions on Antennas and Propagation*, v. AP-7, no. 2, Apr. 1959, p. 117-126. (TK1 In6.6ap Vis.)

10403 Preliminary Results of 400-MC Radar Investigations of Auroral Echoes at College, Alaska. Results of radar investigations of auroral ionization at a frequency of 398 mc are described. The radar detected auroral echoes even when the line of sight from the transmitter does not intersect the earth's magnetic field lines at perfect perpendicular incidence. ***R. L. Leadabrand, L. Dolphin, and A. M. Peterson.*** *IRE Transactions on Antennas and Propagation*, v. AP-7, no. 2, Apr. 1959, p. 127-136. (TK1 In6.6ap Vis.)

10404 Correlation Function and Power Spectra of Radio Links Affected by Random Dielectric Noise. It is shown that in general, the power spectrum of the received signal can be regarded as the output of a network characterized by a time-variable transfer function. The results are applied to a long line of sight radio link and used to predict the error in the received signal in a mean squared sense. ***Dimitri S. Bugnolo.*** *IRE Transactions on Antennas and Propagation*, v. AP-7, no. 2, Apr. 1959, p. 137-141. (TK1 In6.6ap Vis.)

10405 On Scattering by Large Conducting Bodies. The paper deals primarily with two approximate solutions, "the physical optics solution" and "the image induction solution" to problems of electromagnetic wave scattering by large conducting obstacles. ***Roger F. Harrington.*** *IRE Transactions on Antennas and Propagation*, v. AP-7, no. 2, Apr. 1959, p. 150-153. (TK1 In6.6ap Vis.)

10406 Asymmetrical Trough Waveguide Antennas. Designs and radiation patterns are presented for a typical antenna of a continuously asymmetrical form suitable for near endfire radiation, and for a periodically asymmetrical design permitting radiation through broadside. ***W. Rotman and A. A. Oliner.*** *IRE Transactions on Antennas and Propagation*, v. AP-7, no. 2, Apr. 1959, p. 153-162. (TK1 In6.6ap Vis.)

10407 The Equiangular Spiral Antenna. A circularly polarized antenna is described which makes possible bandwidths that a few years ago were considered to be impossible. Antennas have been constructed that have an essentially constant radiation pattern and input impedance over bandwidths greater than 20 to 1. ***John D. Dyson.*** *IRE Transactions and Antennas and Propagation*, v. AP-7, no. 2, Apr. 1959, p. 181-187.

10408 The Influence of Gain and Current Attenuation on the Design of the Rhombic Antenna. The maximum gain condition is discussed together with optimum termination loss, attenuation rates, and surge impedance formulas for multiple wire rhombics. ***R. P. Decker.*** *IRE Transactions on Antennas and Propagation*, v. AP-7, no. 2, Apr. 1959, p. 188-196. (TK1 In6.6ap Vis.)

10409 Frequency Characteristics of a Semiconductor Rectifier at Voltages Greater Than kT/q. The frequency characteristics of a half-wave *p-n* junction rectifier with a resistance load are analyzed for applied voltages greater than kT/q. It is found that at higher applied voltages the half-power frequency is very dependent on voltage as well as load resistance, carrier lifetime and reverse saturation current. ***W. E. Newell, L. Depian, and A. G. Milnes.*** *IRE Transactions on Electron Devices*, v. ED-6, no. 2, Apr. 1959, p. 125-132. (TK1 In6.6ed Vis.)

10410 A Physical Theory of Junction Transistors in the Collector-Voltage-Saturation Region. A physical theory has been formulated for the operation of junction transistors in the "collector-voltage-saturation" region or "on" region. Good agreement between theoretical and experimental results indicates that the approximations used in the theory are valid. The calculation illustrates the use of the theory for quantitative designs of transistor characteristics. ***Chaang Huang.*** *IRE Transactions on Electron Devices*, v. ED-6, no. 2, Apr. 1959, p. 141-153. (TK1 In6.6ed Vis.)

10411 Surface and Geometry Effects on Large Signal Base Input Voltages and Input Resistance of Junction Transistors. A design theory for large signal base input voltage and input resistance of junction transistors is presented with emphasis on the effect of surface recombination and transistor geometry. Based on this theory, design considerations for the large signal input voltage and input resistance are discussed. ***C. Huang, C. M. Chang, and W. Weissenstern.*** *IRE Transactions on Electron Devices*, v. ED-6, no. 2, Apr. 1959, p. 154-161. (TK1 In6.6ed Vis.)

10412 On the Theory of DC Amplification Factor of Junction Transistors. The diffusion equation inside the base region of an alloyed transistor is solved, and an analytic expression for the dc amplification factor is presented in terms of arbitrary bulk lifetime and surface-recombination velocity and the geometry of the transistor. ***S. Wang and T. T. Wu.*** *IRE Transactions on Electron Devices*, v. ED-6, no. 2, Apr. 1959, p. 162-169. (TK1 In6.6ed Vis.)

10413 High-Level Transistor Operation and Transport Capacitance. A two-dimensional analysis of high-level transistor operation is presented which includes the effects of an extended base region, internal emitter biasing, γ-fallout, unequal collector and emitter dimensions, and surface recombination. ***K. E. Mortenson.*** *IRE Transactions on Electron Devices*, v. ED-6, no. 2, Apr. 1959, p. 174-189. (TK1 In6.6ed Vis.)

10414 Bibliography on Electroluminescence and Related Topics. A comprehensive list of references and patents on electroluminescence and related topics. Brief descriptive comments on patents' titles are given. ***Henry F. Ivey.*** *IRE Transactions on Electron Devices*, v. ED-6, no. 2, Apr. 1959, p. 203-215. (TK1 In6.6ed Vis.)

10415 The Variable-Capacitance Parametric Amplifier. The physical principles involved in the operation of the major types of variable-capacitance parametric amplifiers are reviewed and a qualitative explanation is given of the variable-capacitance effect in semiconductor diodes. ***E. D. Reed.*** *IRE Transactions on Electron Devices*, v. ED-6, no. 2 ,Apr. 1959, p. 216-224. (TK1 In6.6ed Vis.)

10416 A Self-Excited Drift-Tube Klystron Frequency Multiplier for Use in Generating Millimeter Waves. Theoretical and experimental considerations are presented in this paper for a self-excited frequency multiplier in which the fundamental oscillator is an integral cavity two-gap klystron and a harmonic resonator is placed at an appropriate position in the drift-tube between the two gaps. The device is capable of generating larger CW output power at millimeter wavelengths than many existing devices. ***W. H. Cornetet, Jr.*** *IRE Transactions on Electron Devices*, v. ED-6, no. 2, Apr. 1959, p. 236-241. (TK1 In6.6ed Vis.)

10417 Radio Telemetering From Within the Human Body. In recent years small radio transmitters have been developed that can transmit physiological information from within the human body. A summary of these recent developments is given along with some of the present lines of investigation toward future forms. ***R. Stuart Mackay.*** *IRE Transactions on Medical Electronics, PGME-6*, June 1959, p. 100-105. (TK1 In6.6m Vis.)

10418 Reflection of a Pyramidally Tapered Rectangular Waveguide. The reflection coefficient of a pyramidally tapered rectangular waveguide is derived by assuming that the taper impedance is proportional to the height and guide wavelength and inversely proportional to the width of the taper cross section. Typical 7-kmc experimental results for several tapers differing in length are presented. ***Katsu Matsumaru.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 2, Apr. 1959, p. 192-196. (TK1 In6.6mt Vis.)

10419 Propagation in a Dielectric-Loaded Parallel Plane Waveguide. A theoretical analysis of wave propagation in a parallel plane waveguide partially filled with a dielectric is performed. This investigation is concerned with TE modes, although hybrid modes can also propagate on this line. In the case of the dominant mode, design curves covering a large range of wavelengths, dimensions, and dielectric constants are presented. ***Marvin Cohn.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 2, Apr. 1959, p. 202-208. (TN1 In6.6mt.)

10420 Electromagnetic Backscattering Measurements by a Time-Separation Method. Investigates the feasibility of adapting the conventional pulsed radar technique for close-range back-scattering measurements for obstacles of arbitrary shape and small scattering cross sections. ***Charles C. H. Tang.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 2, Apr. 1959, p. 209-213. (TK1 In6.6mt Vis.)

10421 Precise Control of Ferrite Phase Shifters. Describes a servo system developed to provide a precise setting of phase in response to a control signal. Performance data are given for various operating conditions of the control system. ***D. D. King, C. M. Barrack, and C. M. Johnson.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 2, Apr. 1959, p. 229-233. (TK1 In6.6mt Vis.)

10422 Delay Distortion in Crystal Mixers. The cause, shape, vanishing condition, etc., of delay distortion are analyzed. The experiments show good agreement with the result of this analysis. ***T. Kawahashi and T. Uchida.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 2, Apr. 1959, p. 247-256. (TK1 In6.6mt Vis.)

10423 Proposal for a Tunable Millimeter Wave Molecular Oscillator and Amplifier. An atomic beam apparatus suitable for a millimeter wave generator is theoretically discussed. ***J. R. Singer.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 2, Apr. 1959, p. 268-272. (TK1 In6.6mt Vis.)

10424 High-Speed Microwave Switching Semiconductors. II. A relationship between low-power isolation and small-signal, low-frequency diode resistance is reported. A theory is presented which agrees with the switching time data and predicts microwave switching times as low as 0.2 to 0.3 mμs. ***Robert V. Garver.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 2, Apr. 1959, p. 272-276. (TK1 In6.6mt Vis.)

10425* Electromechanical Choppers. What They Are—How to Use Them. Discussed are the types of choppers and how they work, the noise of choppers and where they are used. ***R. R. Varsell and W. E. Hodges.*** *ISA Journal*, v. 6, June 1959, p. 42-46.

10426* A Maser Amplifier for Radio Astronomy at X-Band. The design and operating characteristics of a maser radiometer for use in radio astronomy at 3-cm wavelength are discussed. ***J. A. Giordmaine, L. E. Alsop, C. H. Mayer, and C. H. Townes.*** *I.R.E. Proceedings*, v. 47, June 1959, p. 1062-1069.

10427* Tantalum Printed Capacitors. Using sputtered Ta films as the base for the anodized oxide films, excellent results have been achieved employing evaporated metal counter electrodes. Capacitances obtained are comparable to the capacitances-area relationships for Ta electrolytic capacitors formed to the same voltages. DC leakages, however, have been found to be much lower than values reported for those of Ta electrolytic units. Voltages equal to the anodizing voltage may be maintained on the capacitor without impairment. Capacitors have also been produced with thin films of other anodizable metals, evaporated aluminum in particular. ***R. W. Berry and D. J. Sloan.*** *I.R.E. Proceedings*, v. 47, June 1959, p. 1070-1074.

10428* Linear Diversity Combining Techniques. This paper provides analyses of three types of diversity combining systems in practical use. These are: selection diversity, maximal-ratio diversity, and equal-gain diversity systems. ***D. G. Brennan.*** *I.R.E. Proceedings*, v. 47, June 1959, p. 1075-1102.

10429* The Transpolarizer: An Electrostatically Controlled Circuit Impedance With Stored Setting. This new device operates by the controlled transfer of polarization through two or more ferroelectric dielectric sections in series and therefore is named "transpolarizer". ***C. F. Pulvari.*** *I.R.E. Proceedings*, v. 47, June 1959, p. 1117-1123.

10430* A Phenomenological Theory of the Reggia-Spencer Phase Shifter. The novel ferrite-actuated variable phase shifter reported by F. Reggia and E. G. Spencer operates on a principle which, while resembling that of the familiar Faraday rotation devices, differs from them in a way which leads to quite different and unexpected behavior. ***Jerald A. Weiss.*** *I.R.E. Proceedings*, v. 47, June 1959, p. 1130-1136.

10431* A New Look at the Phase-Locked Oscillator. The uses of phase-locked oscillators are briefly reviewed. A simple automatic-phase-control(APC) system is analyzed as a servomechanism analog. Three major characteristics of the system are considered: the lock range, the capture range, and the filter bandwidth. ***Harold T. McAleer.*** *I.R.E. Proceedings*, v. 47, June 1959, p. 1137-1143.

10432* Antimony-Cesium Cells. A study of a pure antimony based photoelectric cell activated by cesium, possessing more sensitivity in the visible spectrum and a better quantum yield than the other photoemissive cells, but with much lower thermionic emission at room temperature. (*In Spanish.*) Celulas de antimonio-cesio. ***Carlos Morgenroth Orozco.*** *Instituto Nacional de Electrónica, Revista de Información Electrónica*, v. 2, no. 6, Apr. 1959, p. 107-115.

10433 On the Theory of the Peltier Heat Pump. The figure of merit for a single stage Peltier heat pump is optimized in the region of partial Fermi degeneracy. A more rigorous treatment is presented of the properties of a cascade operating at maximum coefficient of performance. Finally, the heat leak in the absence of current flow is called to attention as a serious problem in devices with excess capacity. ***E. S. Rittner.*** *Journal of Applied Physics*, v. 30, May 1959, p. 702-707.

10434 Effect of Heat Treatment Upon the Electrical Properties of Indium Arsenide. Large reversible variations in carrier concentration, Hall mobility, and carrier lifetime have been produced in indium arsenide by heat treatment. ***Jack R. Dixon and Dorothy P. Enright.*** *Journal of Applied Physics*, v. 30, May 1959, p. 753-759.

10435* Ionospheric Self-Demodulation and Self-Distortion of Radio Waves. Experiments in which the phenomenon of ionospheric self-demodulation was investigated are described and results obtained are discussed. It was found that self-demodulation decreases as does ordinary cross-modulation, near

dawn. ***J. W. King.*** *Journal of Atmospheric and Terrestrial Physics*, v. 14, nos. 1/2, Apr. 1959, p. 41-49.

10436* The Measurement of the Temperature Dependence of the Mobility and Effective Lifetime of Minority Carriers in the Base Region of Silicon Transistors. The temperature dependence of the mobility of minority carriers in the base region of two Si transistors has been determined by a method previously described. The mobility of holes in the n-type base of a fusion-alloy p-n-p junction transistor was found to vary as $T^{-2.1}$. ***D. M. Evans.*** *Journal of Electronics and Control*, v. 6, no. 3, Mar. 1959, p. 204-208.

10437* Kinetic Theory of Space-Charge. II. Electron Collisional Damping in the Magnetron (and Diode). A detailed phenomenological treatment is given to the electron scattering contribution to magnetron and diode behavior; connection with the strong scattering limit presented earlier is provided along with reduction to the classical conservative motion theory. ***Louis Gold.*** *Journal of Electronics and Control*, v. 6, no. 3, Mar. 1959, p. 209-235.

10438* The Effect of Trigger Pulse Polarity on the Anode Breakdown Time of the Cold Cathode Arc Conduction Tetrode. The anode breakdown time of the cold cathode arc conduction tetrode is found to be dependent on the trigger pulse duration if the trigger pulse is positive, but independent of the pulse duration if the polarity is negative. ***R. Feinberg.*** *Journal of Electronics and Control*, v. 6, no. 3, Mar. 1959, p. 246-257.

10439* Measurement of Magnetic Flux Density by Paramagnetic Resonance. This paper describes a method of measuring magnetic flux density to a high degree of accuracy using a very simple coaxial line apparatus. The method relies on measurement of the paramagnetic resonance at microwave frequencies in an organic compound containing unpaired electron spins. ***C. P. Allen and M. Sherry.*** *Journal of Electronics and Control*, v. 6, no. 3, Mar. 1959, p. 264-270.

10440* The Faraday Effect in Anisotropic Semiconductors. The theory of the Faraday effect in semiconductors is extended to uniaxial crystals with spheroidal energy surfaces, using the classical Drude-Zener theory. Expressions applicable at infra-red frequencies are given and used to discuss preliminary measurements on Bi_2Te_3. ***I. G. Austin.*** *Journal of Electronics and Control*, v. 6, no. 3, Mar. 1959, p. 271-274.

10441 Materials and Processes of Electron Devices. This book is intended to be of assistance to the physicist or engineer concerned with designing and building electron devices such as high-vacuum transmitter- or amplifier tubes, gas- or vapor-filled rectifiers, thyratrons, X-ray or luminescent tubes, glow or incandescent lamps, Geiger- or ionization counters, vacuum photocells, photoconductive cells, selenium-, germanium- or silicon rectifiers or transistors. For this purpose, extensive information is required concerning the composition, behavior and handling of materials as well as a thorough knowledge of high-vacuum technique necessary for processing electron devices after their assembly. The text covers the preparation and working of materials used in these devices; the finishing methods for vacuum tubes (especially degassing, pumping, and getter procedures); and different production steps of solid state devices. ***Max Knoll and B. Kazan.*** 484 pp. 1959. Springer-Verlag, Berlin. (QC544 K75m)

10442* A Technique for the Measurement of Microwave Impedance in the Junction Region of a Semiconductor Device. A known impedance has been devised which permits one to compute the transformation from the measuring point to the junction region. ***M. C. Waltz.*** *Microwave Journal*, v. 2, May 1959, p. 23-27.

10443* Low Noise 400-Mc Reactance Amplifiers. Describes three types of 400-Mc reactance amplifiers. Construction details are discussed and performance data shown for the sum-frequency, two-part difference-frequency, and one-part difference-frequency modes. ***J. C. Green and P. P. Lombardo.*** *Microwave Journal*, v. 2, May 1959, p. 28-31.

10444 Satellite Tracking Simplified. Describes a satellite tracking project making substantial contributions to the art using essentially straightforward and simple combinations of readily available equipment despite a station location 125 miles below the horizon of Cape Canaveral. ***Donald E. Pierce.*** *Military Electronics*, v. 6, May 1959, p. 11-14.

10445* How We Established the Lunar Radio Link. In experiments which began on May 11, workers at Jodrell Bank, Cheshire, have used the moon as a reflector of radio waves to transmit speech, music, and Morse messages to America. This success may be a step towards world-wide communication by reflection from the moon. ***J. V. Evans.*** *New Scientist*, v. 5, May 28, 1959, p. 1176-1178.

10446 Noise in Electron Devices. Provides a comprehensive discussion, stressing the mathematical theory and basic physical phenomena, rather than detailed design techniques. Points of view are presented regarding cathode noise phenomena, signal amplification in microwave tubes, solid-state noise, and methods of designing low-noise tubes. ***Louis D. Smullin and Hermann A. Haus, editors.*** 413 pp. 1959. Technology Press of Massachusetts Institute of Technology and John Wiley & Sons, New York. (TK7835 Sm85n)

10447 Diffusion Capacitance in Transistors. Capacitance measurements have been performed with transistors at different temperatures, voltages, and frequencies. Calculations of the diffusion capacitance (= injection or storage capacitance) have been carried out, taking into account the influence of the second junction. ***K. Böke, J. B. M. Spaapen, and N. B. Speyer.*** *Philips Research Reports*, v. 14, no. 2, Apr. 1959, p. 111-122.

10448 Current-Time Relationship in the Forward Direction of Electrolytic Rectifiers. The shape of the forward current as a function of time is given for an electrolytic rectifier, if an alternating rectangular voltage is applied. The loops in the current-voltage characteristic, which occur when a sinusoidal voltage is applied, are explained. ***W. Ch. van Geel and C. A. Pistorius.*** *Philips Research Reports*, v. 14, no. 2, Apr. 1959, p. 123-131.

10449 Three-Dimensional Electric-Circuit Model of the High-Frequency Phenomena in a Junction Transistor. In order to give a complete explanation of the high-frequency behavior of a junction transistor both minority- and majority-carrier flow must be taken into account. Owing to the large number of complicated boundary conditions, it is not possible to give the solution in a closed mathematical form. ***G. Brouwer.*** *Philips Research Reports*, v. 14, no. 2, Apr. 1959, p. 132-142.

10450 Electron Emission of Materials for Electron Tubes. Describes an investigation of some materials used in the construction of electron tube parts (except cathodes) which, when hot, emit few electrons, thus improving characteristics of some electron tubes, especially those operating at high power. ***G. A. Espersen and J. W. Rogers.*** *Philips Technical Review*, v. 20, no. 9, May 1959, p. 269-274.

10451* Theory of the Origin of the Very Low-Frequency Radio Emissions From the Earth's Exosphere. It has been shown that Gallet's equations can be derived as limiting cases of a more general equation resulting from a quite different mechanism. ***J. W. MacArthur.*** *Physical Review Letters*, v. 2, no. 12, June 1959, p. 491-492.

10452* On the Theory of the Frequency- and Space-Separation Reception With the Far-Distance Tropospheric Propagation of Ultrashort Waves. The dependence of the correlation of the received, frequency- and space-separated signals upon the parameters of the communication line with far-distance tropospheric scattering of U. S. W. and the parameters of the propagation medium is investigated. Formulas and graphs obtained for the correlation function make it possible to calculate separation distances necessary for designing communication systems for beyond-the-horizon operation. (*In Russian.*) K teorii raznesënnogo priëma pri dal'nem troposfernom rasprostranenii UKV. ***A. V. Prosin and V. F. Gubskii.*** *Radiotekhnika*, v. 14, no. 5, May 1959, p. 23-33.

10453* Increasing Probability of Detecting Radar Station Signal. An analysis of the detection of radar station signals by means of specialized radio equipment. A formula is derived for computing the increasing probability of detecting the signal depending on the probability of its reception and the number

of revolutions of the station antenna. (*In Russian.*) Narastaiushchaia veroiatnost' obnaruzheniia signala radiolokatsionnoĭ stantsii. ***N. M. Sediakin.*** *Radiotekhnika,* v. 14, no. 5, May 1959, p. 44-48.

10454* On the Calculation of Vacuum Tube Oscillator Operating Under a Varying Complex Load. Calculation formulas are derived which make possible a rapid and sufficiently exact calculation of a V-T generator under various operating conditions. (*In Russian.*) O raschëte lampovogo generatora pri rabote na peremennuiu kompleksnuiu nagruzku. ***Z. I. Model' and N. S. Fuzik.*** *Radiotekhnika,* v. 14, no. 5, May 1959, p. 49-61.

10455* Transfer Characteristic of a Semiconductor Triode Taking Into Account Feedback. General expression is derived for the transfer characteristic of a semiconductor triode with the grounded base and controlled by an e.m.f. generator with a finite internal impedance. Feedback resulting from the base resistance has been taken into account. (*In Russian.*) Perekhodnaia Kharakteristika poluprovodnikovogo trioda s uchetom obratnoi sviazi. ***A. A. Grinberg.*** *Radiotekhnika,* v. 14, no. 5, May 1959, p. 62-65.

10456* Theory and Design of Ionic Invertors Used for Feeding Radio Devices. Describes the theory and methods for calculating 3-phase invertor with capacitive commutation operating under active-inductive load. Basic parameters of the invertor are determined, and methods of regulating and correcting the form of A-C voltage are described. (*In Russian.*) Teoriia i raschët ionnykh invertorov, primeniaemykh dlia elektropitaniia radioustroĭstv. ***V. M. Savel'ev.*** *Radiotekhnika,* v. 14, no. 5, May 1959, p. 66-75.

10457* High-Speed Dekatron of a Single-Pulse Type. Describes a new cold-cathode counting tube, dekatron of the OG 3 type with the counting rate of 20 to 30 thousand pulses per second. (*In Russian.*) Bystrodeĭstvuiushchiĭ dekatron odnoimpul'snogo tipa. ***G. M. Iankin, F. M. Iablonskii and I. Ia. Breĭdo.*** *Radiotekhnika,* v. 14, no. 5, May 1959, p. 76-78.

10458* New Measuring Equipment for Long-Range Communications. Brief report on interesting new measuring sets designed for carrier, very high frequency and microwave. Improvements of carrier level-meter setups for balanced and coaxial lines. Attention is drawn to the first measuring equipment to operate with white noise. (*In German.*) Neue Messgeräte für die Nachrichten-Weitverkehrstechnik. ***Hanskarl Liersch.*** *Siemens Zeitschrift,* v. 33, no. 4, Apr. 1959, p. 184-190.

10459* Underwater Television. An underwater television equipment for submarine salvage operations and investigations is described. The surface equipment comprises a pulse generator and monitor (14-inch screen), a press-to-talk intercom system for communication with the diver and instruments indicating the diving-depth, etc. (*In German.*) Unterwasser-Fernsehen. ***Hans Leidholdt.*** *Siemens Zeitschrift,* v. 33, no. 4, Apr. 1959, p. 277-278.

10460 Doppler VOR Extends Use of Omniranges. Site error, the most serious limitation of visual omnirange stations, can now be overcome. Doppler-type of VOR station has cut site error to negligible proportions. ***James Holahan.*** *Space/Aeronautics,* v. 31, no. 6, June 1959, p. 118-121.

10461 What the Designer Faces in Active Satellite Communications. Discussed are the difficulties in designing. It is pointed out that at the present time the solar energy will be the primary source of energy, but later on nuclear or other novel sources will be available. *Space/Aeronautics,* v. 31, no. 6, June 1959, p. 122-125.

10462 Three Pacesetters for Tomorrow's Aerospace Electronics. Three developments of great importance have been announced in the very last time: progress in the micromodule program, semiconductor solid state circuits, and a new-type of electron tube (the *"nuvistor"*). *Space/Aeronautics,* v. 31, no. 6, June 1959, p. 135 + 6 pages.

10463 Lattice Mobility of Thermal and Hot Carriers in Germanium. Recent information obtained about the thermal vibrations, and new theoretical calculations, have provided a better insight into the influence of temperature and field on the mobility. An account of the theory of lattice mobility incorporating the new developments is presented in this article. ***Esther M. Conwell.*** *Sylvania Technologist,* v. 12, no. 2, Apr. 1959, p. 30-36.

10464 A New Method for Graphical Reproduction of Cathode-Ray Oscillograms. An automatic device for tracing the waveform of a repetitive oscilloscope pattern has been developed. The waveform is accurately reproduced and magnified by a conventional X-Y recorder. Because optical and pulse techniques are used, the system is capable of reproducing signals displayed on even the fastest available oscilloscopes. ***Robert K. Swank and Eugene A. Mroz.*** *U. S. Atomic Energy Commission, ANL*-5985, May 1959, 20 pp. (UF767 Un3.1an Contin.)

10465 Model 101-A Four-Beam Oscilloscope. The oscilloscope described here may be used in experiments when it is desirable to show several related events on the same linear time base. All the data are displayed on a single oscilloscope tube. ***John G. Winston.*** *U. S. Atomic Energy Commission, LA*-2281, May 26, 1959, 31 pp. (UF767 U3La Contin.)

See also: **10323** (survey of present status of superconducting circuit components); **10328** (thin magnetic films); **10329** (digital data transmission over narrow-band lines); **10337** (electronic countermeasures); **10349** (transistorized carrier-current transmitter-receiver); **10350** (high-speed readout); **10355** (analog function generator); **10820** (diffusion in ionic semiconductors); **10838** (making junctions in Si by solid state diffusion).

ENGINEERING ECONOMICS

10466 Six Types of Firms and the Data Each Needs. A study in England, corroborated by the actual practice of some American corporations, discloses that companies quite unlike each other can profitably share certain internal figures, using them to measure managerial performance and make other helpful comparisons. ***Charles F. Johnson.*** *American Business,* v. 29, May 1959, p. 7-9.

10467* Estimating Manufacturing Costs for Project Evaluation. By concentrating on the more significant factors involved, such as capital, labor, maintenance, raw material costs, etc., the economic evaluation of a process can be simplified and a fair idea of manufacturing costs can be obtained. ***J. E. Cran.*** *Chemical & Process Engineering,* v. 40, May 1959, p. 175-178.

10468 The Use of Outside Engineering Agencies. When should consultants, independent engineering firms, research organizations be called in? ***Nevin K. Hiester.*** *Chemical Engineering Progress,* v. 55, Feb. 1959, p. 130 + 2 pages.

10469* Cost Study in Process Research. Author outlines and explains four different approaches to working out of cost estimates. ***Sidney Katell.*** *Cost Engineering,* v. 4, no. 2, Apr. 1959, p. 24-26.

10470 Integrating Your Transportation for Profit. Fast-moving developments in transportation are bringing new profit opportunities for management. Key to the payoff: integrating all the activities involved in getting goods to market. This report pinpoints what is now being done throughout industry to take advantage of new developments in physical distribution. *Dun's Review and Modern Industry,* v. 73, no. 6, June 1959, p. 60 + 50 pages.

10471* Problem-Solving Math Made Easy. Here are new approaches to statistical engineering. ***Dorian Shainin.*** *Factory,* v. 117, June 1959, p. 84-90.

10472* How You Can Hit the High Cost of Handling in Maintenance. The author gives six cardinal rules for rich savings in plant maintenance. ***John D. Wray.*** *Factory,* v. 117, June 1959, p. 94-100.

10473* How a Pro Looks at Maintenance Cost Reduction. This article by *Factory's* plant maintenance editor was pre-

sented at the 11th Annual Conference of the Philadelphia Chapter of S.A.M. ***Carl Wyder.*** *Factory*, v. 117, June 1959, p. 222 + 9 pages.

10474* **Foreign Commerce Handbook.** Basic information and a guide to sources. 13th Ed. 151 pp. 1959. Chamber of Commerce of the United States, Washington, D. C. (HF1010 C35f Ref.)

10475 Cost-Cutting Ways to Improve Plant Maintenance Programs. Efficient plant maintenance hinges on good planning, wise scheduling, and proper execution of assignments. Here are cost-cutting ideas you can apply to all three functions. ***Marshall Dyer.*** *Iron Age*, v. 183, no. 21, May 21, 1959, p. 139-141.

10476 Why Price-Level Depreciation? There are a number of ways of looking at the problem of depreciation reform. To some, price-level depreciation is the most logical. From a professional accountant, here are the reasons for the price-level approach to depreciation reform. ***L. T. Welsh.*** *Iron Age*, v. 183, no. 21, May 21, 1959, p. 144-146.

10477 Linear Programming and Economic Analysis. This book is intended to give the economist, who knows existing economic theory but who does not pretend to be an accomplished mathematician, a broad introduction to the theory of linear programming, or, as it is sometimes called, activity analysis. ***Robert Dorfman, Paul A. Samuelson, and Robert M. Solow.*** 525 pp. 1958. McGraw-Hill, New York. (HB71 D73L)

10478 1958 Oil and Gas Developments in Ohio. ***George G. Shearrow and Theodore A. DeBrosse.*** *Ohio. Geological Survey. Report of Investigations No.* 37, 1959, 29 pp. (QE151 Oh3re Vis.)

10479 The Technical Survey—Why and How. An application or the systems-engineering approach to market research on radically new technical products. ***William S. Bennett.*** *Product Engineering*, v. 30, no. 24, June 15, 1959, p. 38-40.

10480* Consumer Testing as a Guide to Product Development. Consumer testing has great value in its ability to give the technical researcher an unbiased measure of the all-important effect of product qualities on consumer acceptance. ***N. H. Ishler.*** *Society of Cosmetic Chemists, Journal*, v. 10, no. 3, May 1959, p. 176-186.

10481 Market Forge Pins Growth on R & D. Gives findings of Market Forge Company on development of new products by small companies. *Steel*, v. 144, May 18, 1959, p. 62-63.

10482 U. S. Income and Output. This volume does more than bring up to date the material contained in the 1954 edition of *National Income*. Not only have new series and formulations been added, but the range of subject matter has been broadened to include work in the field of income distribution. ***Charles F. Schwartz and George Jaszi.*** 241 pp. 1958. Available from Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. (HC101 Un3.1u Over.)

See also: **10544** (Ohio mineral reserves); **10566** (lignite mining costs); **10946** (costs for Ni ingot from nickel oxide).

FLUID MECHANICS

10483 Generalized Solution for the Problem of Pipe Flow With Friction and Heat Addition. A generalized chart method is presented for the rapid solution of pipe flow problems involving compressible fluids, including the combined effects of friction and heat addition. ***R. W. McJones and M. L. Caplan.*** *ARS Journal*, v. 29, May 1959, p. 366-368.

10484* A Solution of the Problem of the Plane Laminar Station of a Liquid in an Open Channel. An attempt to solve the problem of the non-uniform motion of a real liquid without any limiting assumptions. (*In Russian.*) Ob odnom reshenii zadachi ploskogo laminarnogo dvizheniia zhidkosti v otkrytom kanale. ***G. A. Babadzhaniai and A. G. Nazarian.*** *Akademiia Nauk Armianskoĭ SSR, Izvestiia. Seriia Fiziko-Matematicheskikh Nauk*, v. 12, no. 1, 1959, p. 61-73.

10485* Flow Distributions in Manifolds. Calculations based on one-dimensional flow equations have been carried out for channels having constant cross-sections, using computing machines. The results are applicable to a wide variety of combinations of channel dimensions, fluid velocity and physical properties, and pressure drop across the side ports. The results are summarized by charts that permit a designer quickly to estimate the nonuniformity in the flow pattern. Predicted distributions agree approximately with observed flow patterns. ***A. Acrivos, B. D. Babcock, and R. L. Pigford.*** *Chemical Engineering Science*, v. 10, nos. 1/2, Apr. 1959, p. 112-124.

10486 Heat Transfer From a Flat Surface to a Parallel Stream of Water. ***A. J. Ede and O. A. Saunders.*** *Institution of Mechanical Engineers, Proceedings*, v. 172, no. 23, 1958, p. 743-758 + 2 plates.

10487* Theory of Classical Fluids: Hyper-Netted Chain Approximation. II. Formulation for multi-component systems. ***Tohru Morita.*** *Progress of Theoretical Physics*, v. 21, no. 3, Mar. 1959, p. 361-382.

10488 Surveys in Applied Mathematics. v. III. Mathematical Aspects of Subsonic and Transonic Gas Dynamics. Concerns two-dimensional steady potential flows as a limited part of the theory of compressible fluid flow. "Applications" of fluid dynamics as a source of mathematical concepts are stressed. ***Lipman Bers.*** 164 pp. 1958. John Wiley & Sons, Inc., New York. (QA930 B46m)

10489* A Boundary Value Problem for Linearized Equations of Viscous Fluid Dynamics. (*In Russian.*) Ob odnoĭ granichnoi zadache dlia linearizovannykh uravneniĭ gidrodinamiki viazkoĭ zhidkosti. ***S. S. Litvinkov.*** *Akademiia Nauk SSSR, Doklady*, v. 125, no. 5, Apr. 11, 1959, p. 998-1001.

See also: **10010** (fluid dynamics in Hg-H_2O spray columns); **10015** (liquid flow through an annulus); **10045** (fluid dynamics and heat transfer).

FOOD TECHNOLOGY

10490* Opportunities in International Nutrition Research. Discusses problems of riboflavin requirement, of iron and hookworm, of heart disease and artherosclerosis. ***D. Mark Hegsted.*** *American Dietetic Association, Journal*, v. 35, July 1959, p. 669-671.

10491* Application of Flavor Enzymes to Processed Foods. II. Comparison of the Effect of Flavor Enzymes From Mustard and Cabbage Upon Dehydrated Cabbage. The same mustard oils are released from commercially dehydrated cabbage by cabbage and mustard enzyme. Mustard oils are not found in untreated dehydrated cabbage, but apparently are released from commercially dehydrated cabbage at a greater rate by the cabbage enzyme than by the mustard enzyme. ***D. A. M. Mackay and E. J. Hewitt.*** *Food Research*, v. 24, no. 3, May-June 1959, p. 253-261.

10492 Food Microbiology. The material presented has been summarized and digested, giving what is considered to be the present belief on controversial subjects. Principles are emphasized, and usually only a few illustrative examples are selected from the many available. Covers the utilization of radiations, and the addition of antibiotics in food preservation. ***William Carroll Frazier.*** 472 pp. 1958. McGraw-Hill, New York. (QR115 F86f)

10493* Radiation Preservation of Milk and Milk Products. IX. Comparison of Bactericidal Effects of Cathode Rays, Gamma Rays and Ultraviolet Light. ***B. LaFuente, S. A. Goldblith, and B. E. Proctor.*** *Food Technology*, v. 13, May 1959, p. 272-275.

10494* The Use of Isolated Soybean Protein for Non-Meat, Simulated Sausage Products, Frankfurter and Bologna Types. ***S. S. Frank and S. J. Circle.*** *Food Technology*, v. 13, June 1959, p. 307-313.

10495* Improvement of Potato Granule Quality by Fluidized Bed Finish Drying. Fluidized bed finish drying has been shown to be a practical means of obtaining moisture levels of as low as 5% in potato granules. ***Mabry T. Roby and Morris Simon.*** *Food Technology*, v. 13, June 1959, p. 327-331.

10496 Pesticides and Flavor. Flavor Changes of Some Fruits and Vegetables Treated With Pesticides. ***Margaret McGregor Hard and Edward Ross.*** *Journal of Agricultural and Food Chemistry*, v. 7, June 1959, p. 434-435.

10497 Corrosion in Food Containers. The Mechanism of Corrosion of Tin Plate by Various Food Products. The corrosion mechanism of tin plate is a function of the food product in which the tin plate is corroding. ***Robert P. Frankenthal, Paul R. Carter, and Aner N. Laubscher.*** *Journal of Agricultural and Food Chemistry*, v. 7, June 1959, p. 441-442.

FUELS AND COMBUSTION

10498 Burning Rate of an H-Atom Propellant. An attempt to calculate *a priori* the one-dimensional burning rate of an H-atom propellant. ***Howard B. Palmer.*** *ARS Journal*, v. 29, May 1959, p. 365-366.

10499 The Recently Developed Burstlein-Longwy Process for Coke Production From Bituminous and Nonbituminous Coals. This process was installed at the Thionville Coke plant, France, in 1951. Reports progress made since that time and tells of reception of this process in France and other countries. ***E. Burstlein.*** Paper from "Blast Furnace, Coke Oven, and Raw Materials Committee of the Iron and Steel Division, Proceedings," v. 17, American Institute of Mining, Metallurgical, and Petroleum Engineers, New York. 1958, p. 66-78. (Tn713 Am35p)

10500* New Types of Smokeless Fuels. Processes developed from the fluid bed method of carbonization to produce an improved briquette are being operated in experimental plants at the Coal Research Establishment. The next stage will be building of a pilot plant and testing of the product on the market. ***D. C. Rhys Jones.*** *New Scientist*, v. 5, May 7, 1959, p. 1008-1010.

10501* Underground Gasification. Is U. S. Second Best? Utilization of unminable coal. Russian results. American program lags. *Power Engineering*, v. 63, May 1959, p. 66-68.

10502* Behavior of Coke Stressed by Drop and Compression. Drop shatter tests with graded coke. Influence of the number of drops and height of drop on the degree of disintegration. Comparison between drop shatter and compression stress. (*In German.*) Verhalten von Koks bei Beanspruchung durch Sturz und Druck. ***Hermann Schenck and Hans Esch.*** *Stahl und Eisen*, v. 79, no. 11, May 28, 1959, p. 769-777.

10503 Review and Status of Low-Temperature Tar Investigations of the Bureau of Mines. *U. S. Bureau of Mines Information Circular* 7893, 1959, 32 pp. (TN21 Un3i Vis.)

10504 Duplicability Studies of the BM-AGA Test Method and Correlation With Industrial Coking. Results of statistical analyses of carbonization data from 800, 900, and 1000 C tests in the BM-AGA test apparatus. Values are given for duplicability of yields of coke, gas, tar, and NH_3, duplicability of apparent specific gravity and strength indexes of cokes, reproducibility between pairs of coke samples from the same retort, and correlations relating BM-AGA and industrial carbonization data. ***J. G. Walters and G. W. Birge.*** *U. S. Bureau of Mines Report of Investigations* 5467, 1959, 16 pp. (TN21 Un3r Vis.)

10505 Evaluation of an Acid-Extraction Method for Determining Mineral Matter in American Coals. A German procedure was investigated to determine its application to American coals. It was found to be suitable for all ranks of coal from anthracite to lignite with little modification. ***E. C. Tarpley and W. H. Ode.*** *U. S. Bureau of Mines Report of Investigations* 5470, 1959, 15 pp. (TN21 Un3r Vis.)

See also: **10018** (hydrogenation of coker distillate from athabasca bitumen); **10046** (treatment of lower grade gas turbine fuels); **10068** (gasoline plant design); **10566** (lignite mining methods).

GEOLOGY, GEOPHYSICS, MINERALOGY, AND MINING ENGINEERING

10506 The Earth and Inertial Space. II. Shape of the Earth. Discussing the shape of the earth and its effect on inertial navigation parameters. ***Richard H. Parvin.*** *Aero/Space Engineering*, v. 18, May 1959, p. 33-36.

10507* Epigene Minerals as Time Indicators of Oil Appearance in Industrial Sand Oil Reservoirs. Epigene minerals usually contain no petroleum and can, thus, serve as time indicators. (*In Russian.*) Epigennye mineraly kak pokazateli vremeni prikhoda nefti v peschanye promyshlennye kollektory. ***K. P. Chepikov, E. P. Ermolova, and N. A. Oplova.*** *Akademiia Nauk SSSR, Doklady*, v. 125, no. 5, Apr. 11, 1959, p. 1097-1099.

10508* On Oceanic Currents. Shows that important oceanic depth currents exist and that they can be studied by means of anchor buoy stations equipped with automatic self recorders. (*In Russian.*) O techeniiakh v okeane. **N. N. Sysoev.** Akademiia *Nauk SSSR, Doklady*, v. 125, no. 5, Apr. 11, 1959, p. 1123-1125.

10509* Origin of Petroleum. The distributions of petroleum hydrocarbons in petroleum differ from their distributions in sediments. Explains how water can produce these changes in distribution. ***W. G. Meinschein.*** *American Association of Petroleum Geologists, Bulletin*, v. 43, May 1959, p. 925-943.

10510* The Fine Structure of the Magnetic Field and the Depolarization of Radiation in Sunspots. Photoelectric recordings of magnetic fields of sunspots at high resolving power show the fine structure of the field with characteristic size of several seconds of arc. The disappearance of the line of sight component and the frequent appearance of the Zeeman triplet in umbrae can be connected with the depolarization of the Zeeman pattern produced by fluctuations of the field leading to fluctuations in the magnetic rotation of the plane of polarization. (*In Russian.*) Tonkaia struktura magnitnogo polia i depolarizatsiia izlucheniia v solnechnykh piatnakh. ***A. B. Severnyi.*** *Astronomicheskii Zhurnal*, v. 36, no. 2, Mar.-Apr. 1959, p. 208-214 + 1 plate.

10511* Some Results of Statistical Treatment of Geomagnetic Disturbances on the Declining Branch of Solar Activity. (*In Russian.*) Nekotorye rezul'taty statisticheskoĭ obrabotki geomagnitnykh vozmushcheniĭ na niskhodiascheĭ vetvi solnechnoĭ aktivnosti. ***O. N. Mitropol'skaia.*** *Astronomicheskii Zhurnal*, v. 36, no. 2, Mar.-Apr. 1959, p. 224-232.

10512* On Accounting for the Aberration of Planets. A system of formulas and rules for accounting for the aberration of planets with a precision to 0.001″-0.002″ are given. (*In Russian.*) Ob uchete aberratsii planet. ***D. K. Kulikov.*** *Astronomicheskii Zhurnal*, v. 36, no. 2, Mar.-Apr. 1959, p. 340-347.

10513 The Chemistry of Manganese Deposits. A new geochemical approach relating the chemical composition of North American Mn deposits to the igneous rock from which they originated. ***W. R. Trost.*** *Canada, Mines Branch, Research Report*, R-8, June 4, 1958, 125 pp. (TN26 C16.5r Contin.)

10514* The Role of Air Photo Interpretation in the Integrated Exploration Programme. Aerial photography in the planning stages of an exploration project. ***Nelson Hogg.*** *Canadian Mining Journal*, v. 5, May 1959, p. 67-74.

10515 Efficient Thin-Seam Stripping Serves Utility Market. Close supervision of drilling and blasting, skillful operation of a 30-cu yd stripping shovel and coal preparation with a minimum of manpower are keys to successful stripping of 26-in coal at Peabody Coal's new Tebo mine near Calhoun, Mo. *Coal Age*, v. 64, May 1959, p. 80 + 5 pages.

10516* Algoma Uranium, Mining Methods. Details some of the technical aspects of taking the ore from the ground at the U strike between Sudbury and Sault Ste. Marie in Ontario, Canada. Methods and equipment used in both track and trackless mining are explained. ***R. J. Nemmers.*** *Compressed Air Magazine*, v. 64, May 1959, p. 12-18.

10517* The Sulfuration of Crude Oils. Two crude oil samples studied showed a sulfur fixation of 5% after 144 hours and of 33% on one and 30% on the other after 252 hours. Sulfur was fixed on each constituent except on the resins of the second sample. (*In French.*) Sur la sulfuration des pétroles bruts. ***Marcel Louis.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 248, no. 15, Apr. 13, 1959, p. 2229.

10518* Drilling Muds and Additives. Technical characteristics, trade name and classification, product and/or application, of many products are tabulated. *Drilling*, v. 20, May 1959, p. 59 + 7 pages.

10519 The Earth and Its Atmosphere. Provides a readable scientific background necessary for a genuine understanding of the I.G.Y. program with papers by 15 leading geophysical scientists. ***D. R. Bates, editor.*** 324 pp. 1957. Basic Books, Inc., New York. (QC806 B31e)

10520* Sulfur Isotopes and Hydrothermal Mineral Deposits. Suggests that S isotope ratios may provide an additional "tool" to learn more about the different sources of hydrothermal solutions and obtain a better understanding about the processes by which hydrothermal mineral deposits have been formed; and that hydrothermal deposits might be subdivided according to different ore fluid sources. ***M. L. Jensen.*** *Economic Geology*, v. 54, no. 3, May 1959, p. 374-394.

10521 Extensive Air Showers. Principal interest is with those incoming cosmic particles of greatest energy, the arrival of which is indicated by the generation within the 20 kilometers or so of atmosphere above the earth of a complex sequence of events which we call an 'extensive air shower'. ***William Galbraith.*** 211 pp. 1958. Academic Press, New York. (QC485 G13e)

10522 The Geochemistry of Rare and Dispersed Chemical Elements in Soils. Methods used in the study of soil composition. Relationship of the chemical element to the rock type and geological setting of the soil. ***A. P. Vinogradov.*** (Translated from the Russian.) 2nd Rev. Ed. 209 pp. 1959. Consultants Bureau, Inc., New York. (QD172.R2 V77g2tr Over.)

10523* The Abundances of Gallium and Germanium in Terrestrial Materials. A sensitive spectrophotometric method using phenylfluorone has been applied to the determination of Ge in over 200 minerals, rocks, sediments, and in sea water. ***J. D. Burton, F. Culkin, and J. P. Riley.*** *Geochimica et Cosmochimica Acta*, v. 16, nos. 1-3, May 1959, p. 151-180.

10524* Distribution of Manganese in Sedimentary Rocks. Manganese determination in 26,000 samples of rocks (sandstones, clays and carbonate rocks) of sediments of postproterozoic geological systems showed regularities of Mn distribution in time and in the area of basins of the Russian platform, with maximum content near shore marine facies. (*In Russian.*) Raspredelenie margantsa v osadochnykh porodakh. ***A. B. Ronov and A. I. Ermishkina.*** *Geokhimiia*, 1959, no. 3, p. 206-225.

10525* On the Forms of Uranium Occurence in Granites. An investigation through comparative leaching of the U out of rocks and minerals with a 0.2 *N* solution of Na_2CO_3. Uranium seems to have the highest capacity to be leached out of rocks and minerals when present in the form of secondary minerals or oxides. (*In Russian.*) O formakh nakhozhdeniia urana v granitakh. ***A. Ia. Krylov and L. Ia. Atrashenok.*** *Geokhimiia*, 1959, no. 3, p. 246-251.

10526* Peculiarities in the Abundance of Some Rare Elements in Metamorphous Rocks, Granites and Rare-Earth Pegmatites of the Sayany. A considerable concentration of Li and Be in rare earth pegmatites compared to the content of these elements in granites is ascertained and an increase of the Rb and Cs amount from more ancient rocks—schists amphibolites to younger rocks—granites and pegmatites. (*In Russian.*) Osobennosti rasprostraneniia nekotorykh redkikh elementov v metamorficheskikh porodakh, granitakh i redkometal'nykh pegmatitakh Saian. ***Iu. S. Slepnev.*** *Geokhimiia*, 1959, no. 3, p. 252-258.

10527* Future Trends in Instrumentation and Control in the Coal Mining Industry. Outlines present position with regard to those instruments that are now being used, and indicates what are likely to be future trends in underground instrumentation. ***A. E. Bennett.*** *Instrument Practice*, v. 13, Apr. 1959, p. 417-423.

10528* The Use of Scale Models in Tectonophysics. Uses the theory of physical similarity as developed in the U.S.S.R. and equations describing the development of folds and faults in rocks. Theoretically proves the possibility of using scale models in tectonophysics. ***M. V. Gzovsky.*** *International Geology Review*, v. 1, Apr. 1959, p. 31-47.

10529* Use of the Replica Method for Studying Ice Crystals. A method for investigations of the solid phase in clouds and fogs. (*In Russian.*) Primenenie metoda replik k izucheniiu ledianykh kristallov. ***A. D. Malkina.*** *Izvestiia Vyshikh Uchebnyk, Zavedenĭ Fizika*, 1959, no. 1, p. 67-70 + 1 plate.

10530* Solar Activity and Transient Decreases in Cosmic-Ray Intensity. It is possible to attribute these decreases to beams of ionized rarified gas emitted from the sun and differing considerablv in their characteristics. ***D. Venkatesan.*** *Journal of Geophysical Research*, v. 64, no. 5, May 1959, p. 505-520.

10531* Effect of Gas-Oil Ratio on the Behavior of Fractured Limestone Reservoirs. A mathematical model was constructed to duplicate the conditions desired. The model shows that under certain conditions it is possible to recover more oil by producing at high gas-oil ratios than by production at low gas-oil ratios. ***Juan Jones-Parra and Rafael Seijas Reytor.*** *Journal of Petroleum Technology*, v. 11, May 1959, p. 68-70.

10532* A Laboratory Study of Rock Breakage by Rotary Drilling. Effects of drilling variable on rotary drilling rates and efficiencies have been studied by a series of laboratory drilling tests. ***Wilbur H. Somerton.*** *Journal of Petroleum Technology*, v. 11; *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 216, May 1959, p. 92-97.

10533* Sonic Logging. The principle, the equipment and field operation of sonic logging are described. ***M. P. Tixier, R. P. Alger, and C. A. Doh.*** *Journal of Petroleum Technology*, v. 11; *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 216, May 1959, p. 106-114.

10534* The Williamson Diamond Mine. III. This concluding section is concerned with the concentration of diamonds and their final recovery. ***G. J. du Toit.*** *Mine & Quarry Engineering*, v. 25, May 1959, p. 194-200 + 1 insert.

10535* Blasting With Ammonium Nitrate/Fuel Mixtures. Properties, characteristics, and scope of this blasting agent; mixing methods; some typical applications. ***G. G. Riley and R. Westwater.*** *Mine & Quarry Engineering*, v. 25, May 1959, p. 211-217.

10536* Mining Geophysics. Statistical determination of the "probability of discovery" of geologically interesting areas deserves much more attention, because random searching with expensive equipment and techniques all too frequently produces fruitless and costly results. Once a well-reasoned exploration program has been decided upon, however, management should be prepared to continue it until the program has had a sufficient chance, statistically, to provide a discovery. ***Louis B. Slichter.*** *Mining Congress Journal*, v. 45, May 1959, p. 36 + 4 pages.

10537* Remote Control in Highwall Mining. Consideration of the remotely controlled mining system for Union Carbide. ***J. W. Heimaster.*** *Mining Congress Journal,* v. 45, May 1959, p. 40-44.

10538* Mining by Hydraulic Jet. No blasting, loading, or tramming; simple, dustless operations. ***J. H. Baker.*** *Mining Congress Journal,* v. 45, May 1959, p. 45 + 2 pages.

10539 Photogrammetric Methods and the Open Pit Mine. Photogrammetric methods, integrated with, and adapted to the engineering problems of particular open-pit mine, can provide more accurate maps, in shorter time and at lower cost than the more usual ground-survey methods. ***A. Tremari and Paul I. Eimon.*** *Mining Engineering,* v. 11, May 1959, p. 497-501.

10540 Gyro-Compass Surveys Underground Workings and Boreholes. The gyro-compass is being perfected in accuracy, as well as miniaturized, to a point where mining and civil engineers should consider its application for certain phases of underground surveying. ***Eugene P. Pfleider and Otto Rellensmann.*** *Mining Engineering,* v. 11, May 1959, p. 521-526.

10541 Application of Electron Diffraction and Electron Microscopy to Mineral Engineering. ***J. E. Lawver and G. L. Samsel.*** *Mining Engineering,* v. 11, May 1959, p. 535-536.

10542 A New Theory of the Solar Corona. Suggests a new model of the solar corona consisting of trapped charged particles moving in the magnetic fields of the sun, very like the charged-particle cloud surrounding the earth which has recently been discovered by Van Allen and his collaborators. ***Paul J. Kellogg and Edward P. Ney.*** *Nature,* v. 183, May 9, 1959, p. 1297-1301.

10543* Planetary Observations by the Multi-Balloon Technique. Recent observations of Venus and the Moon are described. Although in some respects the results of the flight were disappointing, this new approach to astronomical ballooning clearly holds high promise. ***Pierre de Latil and Tom Margerison.*** *New Scientist,* v. 5, May 7, 1959, p. 1005-1007.

10544 A Century and a Half of Ohio's Minerals. Production, occurrences, and reserves of coal, oil and gas, and industrial minerals. *Ohio. Geological Survey, Information Circular No.* 24, 61 pp. (QE151 Oh3.3i Vis.)

10545* Measurement of Effective Permeability. Method using radial flow of fluids. ***E. T. Guerrero and F. M. Stewart.*** *Oil and Gas Journal,* v. 57, no. 20, May 11, 1959, p. 92.

10546* Drilling *Can* Be "Overengineered" *but* . . . Controlled weight-speed-penetration studies, plus attention to detail, are keys to faster penetration. ***E. L. Decker.*** *Oil and Gas Journal,* v. 57, no. 20, May 11, 1959, p. 127-129.

10547 Fracturing Pays Off in Eastern United States. Fracturing of water-injection and producing oil wells in secondary-recovery projects is now accepted completion procedure. ***Wendell S. Moore.*** *Oil and Gas Journal,* v. 57, no. 22, May 25, 1959, p. 162 + 3 pages.

10548* Well Acidising History and Development. The commercial applications of increasing oil-well production by acidizing are only some 20 years old. Nowadays, some 250 chemical additives are used in well-treatment processes. ***P. E. Fitzgerald.*** *Petroleum,* v. 22, May 1959, p. 179-180.

10549 Efficiency and Economy Will Result From Engineered Hydraulic Fracture Treatments. II. The equation for calculating fracture areas is reduced to graphical and nomographic solutions showing the effect of each variable on relative efficiency and economy. ***Davis D. Hunt and Horace R. Crawford.*** *Petroleum Engineer,* v. 31, May 1959, p. B25-B28.

10550* New Tools Cut Slant-Drilling Time. Homco's circulating and releasing whipstock permits sediments to be circulated out of the hole before setting, thus eliminating misruns. Homco's mechanical orienting tool is also explained. *Petroleum Week,* v. 8, no. 18, May 1, 1959, p. 25-26.

10551* New Type Drilling Tool Now on Market. New tool operates with air or gas, and has only one moving part. A conventional air-gas rotary rig is "standard equipment" for the percussion tool. *Petroleum Week,* v. 8, no. 21, May 22, 1959, p. 24-25.

10552* More Petroleum Research Is Needed. Lists some of the most urgent problems. *Petroleum Week,* v. 8, no. 22, May 29, 1959, p. 17.

10553* Satellite-Measured Radiation. Discussion of recent satellite and rocket measurements. ***G. W. Stuart.*** *Physical Review Letters,* v. 2, no. 10, May 15, 1959, p. 417-418.

10554* Earth Resistivity Interpretation for Sand and Gravel Prospecting. Demonstrates how an accurate interpretation can be made from a set of field data and describes the difference between a reconnaissance survey and a comprehensive survey, as well as the respective advantages of each. Limitations of resistivity instruments and conditions are explained in order to emphasize the experience and care necessary to develop accurate interpretations. ***Howard E. Barnes.*** *Pit and Quarry,* v. 51, no. 11, May 1959, p. 92-96.

10555 The Polar Regions in Their Relation to Human Affairs. Fourth of a series of lectures. ***Laurence M. Gould.*** 54 pp. + 1 map. 1958. The American Geographical Society, New York. (G595 G73p)

10556 Researches in Geochemistry. Provides a comprehensive view of current research in geochemistry, especially in nuclear geography, geochronology, chemical considerations pertaining to ore solutions, deposits, and prospecting, geochemistry of organic substances, including petroleum, low temperature processes and sedimentation, and considerations important to our view of the interior of the earth. ***Philip H. Abelson, editor.*** 511 pp. 1959. John Wiley & Sons, Inc., New York. (QE515 Ab35r)

10557* Remote Lime Plant Proves Progressive. Description of the Northern Lime Co., Ltd's. new Lime Acres plant in South Africa yielding 30,000 tons of quality lime per month. ***R. E. Lowther.*** *Rock Products,* v. 62, May 1959, p. 120 + 3 pages.

10558 Preliminary Identification of Crystalline Phases in a Transparent Stalactite. Of two crystalline phases found in a cavern stalactite, the major phase is mirabilite, whereas the minor phase, according to preliminary data, is a new mineral, sodium hemicalcium sulfate dihydrate, which is unstable at temperatures above 25 C. ***Fred Bennington.*** *Science,* v. 129, May 1, 1959, p. 1227.

10559 Cenozoic History of the Bering Land Bridge. The seaway between the Pacific and Arctic basins has often been a land route between Siberia and Alaska. ***David M. Hopkins.*** *Science,* v. 129, June 5, 1959, p. 1519-1528.

10560* Some Radio Telescopes. II. Ohio State's instrument at Delaware is among those described. *Sky and Telescope,* v. 18, no. 7, May 1959, p. 370-374.

10561 A Study of the Wind Profile in the Lowest 400 Feet of the Atmosphere. Progress Report No. 2. Based on mean hourly wind speeds measured over a two-year period on the Brookhaven meteorology tower, values of p, the exponent of a power law expression for the wind profile, were computed for two height intervals (37 to 150 ft and 150 to 355 ft) and were related to a number of easily obtained meteorological parameters. ***Irving A. Singer and Gilbert S. Raynor.*** *U. S. Atomic Energy Commission, BNL-540,* Jan. 1959, 25 pp. (UF767 Un3.1bn Contin.)

10562 Mineralogy of Uranium-Bearing Deposits in the Boulder Batholith, Montana. Final Report. ***H. D. Wright, B. H. Bieler, D. O. Emerson, and W. P. Shulhof.*** *U. S. Atomic Energy Commission, NYO-2074,* 237 pp. (UF767 U3ny Contin.)

10563 Geologic Investigations of Radioactive Deposits. Semiannual Progress Report, June 1 to November 30, 1958. *U. S. Atomic Energy Commission, TEI-750,* Dec. 1958, 149 pp. (UF767 Un3t Contin.)

10564 Mineral Resource Development by the Use of Nuclear Explosives. All of the experience with the pertinent effects of nuclear explosives has been obtained in conjunction

with weapons development and testing. Describes the results that are presently available and how they might be employed to problems of mineral exploitation. ***Gerald W. Johnson.*** *U. S. Atomic Energy Commission, UCRL*-5458, Feb. 5, 1959, 18 pp. (UF767 U3u Contin.)

10565 Tin-Placer Sampling Methods and Results, Cape Mountain District, Seward Peninsula, Alaska. Supplements the previous Bureau publication. ***John J. Mulligan and Robert L. Thorne.*** *U. S. Bureau of Mines Information Circular* 7878, 1959, 69 pp. (TN21 Un3i Vis.)

10566 Methods and Costs of Mining Lignite in North Dakota. *J. N. Van Sant and R. C. Ellman.* *U. S. Bureau of Mines Information Circular* 7891, 1959, 82 pp. (TN21 Un3i Vis.)

10567 The Upper Atmosphere. Present day knowledge of the phenomena of this region studied during the IGY is outlined together with the techniques used in investigation. These include the use of sound and radiowaves, spectroscopic devices, searchlights, balloons, rockets and artificial satellites. Radio fade-out, radio absorption, night airglow, aurorae, meteors, cosmic rays and currents for magnetic variations are given detailed attention. ***H. S. W. Massey and R. L. F. Boyd.*** 333 pp. 1959. Philosophical Library, Inc. New York. (QC879 M38u)

10568* Gilsonite Reduces Lost Circulation When Cementing. This lightweight additive increases compressive strength of cement, maintains good corrosion resistance properties, and shows no softening effect at high temperatures. ***Knox A. Slagle and L. Gregory Carter.*** *World Oil*, v. 148, May 1959, p. 167-170.

10569* Seismic Velocity Effects May Hide Organic Reefs. II. The approximate magnitude of velocity contrasts and false seismic structures produced by little known limestone bodies can be estimated with a moderate amount of geologic data. ***DeWitt C. Van Siclen.*** *World Oil*, v. 148, May 1959, p. 178-182.

10570* New Techniques Are Opening up New Areas to Air and Gas Drilling. Use of chemicals to combat the influx of formation water. Development of an efficient water shut-off which has opened many new areas heretofore condemned for economical air and gas drilling. Air and gas drilling in cleaning out and stimulating old producing wells. ***F. W. Smith.*** *World Oil*, v. 148, May 1959, p. 188-190.

10571* Drill Stem Logging Tool Is Successful. A new electric logging method. Surveys are obtained without removing pipe from the hole. ***P. E. Chaney, F. M. Mayes, J. W. Jones, and John D. Bennett.*** *World Oil*, v. 148, May 1959, p. 191 + 2 pages.

10572* Volcanic Ash (Pozzolan) Improves Oil Field Cementing Practices. Pozzolanic cements offer less cost, lighter density and lower fluid loss properties. ***C. M. Stout and J. E. Strassner.*** *World Oil*, v. 148, June 1959, p. 114-118.

10573* Analysis of Hydrocarbons in Well Site Drilling Mud. Gas chromatography is a rapid and accurate method for detecting oil and gas in mud streams. ***Hoke R. Chism, William Scott, and Robert A. Karas.*** *World Oil*, v. 148, June 1959, p. 138-140.

10574* Geophysical and Core-Drill Study of Mojave Desert Completed. A survey of 75,000 acres in search of minerals and rare earths. ***Quinton Peters.*** *World Petroleum*, v. 30, May 1959, p. 116A + 1 page.

See also: **10478** (Ohio oil and gas developments); **10501** (underground gasification of coal).

GRAPHIC ARTS

10575 Flexographic Printing. A thorough description of the process formerly known as "aniline printing". ***F. E. Boughton.*** 121 pp. 1958. F. E. Boughton, Chicago. (Z244 B66f)

10576* The Role of the Hard Dot Positive in the Gravure Process. Rather than being a unique factor, dot hardness is only one of many process elements that influence print quality. Just how important dot hardness is cannot be finally determined until its effect has been unwoven from the multitude of other equally important factors, by carefully designed and controlled experiments. ***James M. Dugan and T. A. Pine.*** *Gravure*, v. 5, June 1959, p. 16 + 4 pages.

10577 Photographic Chemistry. Allied subjects are covered very nearly as completely as the main topic. Notations of original works makes the book a good reference source. ***Pierre Glafkides.*** v. I. 491 pp. 1958. Fountain Press, London. (TR210 G45c2tr)

HEAT POWER

10578 Heat Transfer Character of Wire-and-Tube Heat Exchangers. Characteristics have been determined for different angular positions of the exchanger between horizontal and vertical in both unconfined space and between confining parallel walls. The elementary unit geometry for computing the heat rate and the effect of off-vertical angular position on the convection coefficients have been determined. ***J. A. Cyphers, R. D. Cess, and E. V. Somers.*** *ASHRAE Journal*, v. 1, May 1959, p. 86 + 5 pages.

10579* Aircraft and Spacecraft Propulsion. Energy sources, propellants, materials, heat transfer fluids, and powerplants for rockets and missiles. ***A. M. Rothrock.*** *Canadian Aeornautical Journal*, v. 5, no. 5, May 1959, p. 172-183.

10580* LDS "Hypercycle" Multifuel Engine. Continental's new engine utilizing M-Combustion system shows good economy on a wide range of fuels. *Diesel Power*, v. 37, May 1959, p. 26-27.

10581* Radioactive Liner Used in Diesel Wear Test. Supersensitive technique of measurement now applied to determining liner wear. *Diesel Power*, v. 37, May 1959, p. 27.

10582* Organising Production With Back Pressure Steam Plant. Manufacturing processes and steam and power can be correlated to maintain both high productivity and high efficiency of fuel utilization. ***W. Lamb.*** *Fuel Efficiency*, v. 7, May 1959, p. 27 + 2 pages.

10583* Gas Turbine Applications in the Petroleum and Allied Industries. Turbine exhaust uses, thermofor catalytic process, and application in fluid hydroforming process. *Gas and Oil Power*, v. 54, May 1959, p. 142-144.

10584 A Brief Survey of Direct Energy Conversion Devices for Possible Space-Vehicle Application. Reviews four types of devices for converting heat or radiant energy directly into readily available electrical form. ***A. E. Von Doenhoff and D. A. Premo.*** *IRE Transactions on Military Electronics*, v. MIL-3, no. 2, Apr. 1959, p. 46-51.

10585 Astronautics and Propulsion. Proposed exotic propulsion systems are quite old, as far as the concepts proper are concerned. ***Krafft A. Ehricke.*** *IRE Transactions on Military Elecceronics*, v. MIL-3, no. 2, Apr. 1959, p. 58-64.

10586* Will Your New Power Plant Be Really Modern? Presents latest developments in the design of equipments used in the modern power plant, covers water control, pumps, valves, and ideas that simplify maintenance. ***Paul N. Garay.*** *Power Engineering*, v. 63, May 1959, p. 75-76.

10587* Thermiatries: Study of the Diseases of High Temperature Boilers. Tube failures in modern central boilers frequently result from spontaneous growths of iron oxide in regions of high heat transfer. Modifying boiler water chemistry does not appear to be the answer to all such types of tube failures. ***Douglas E. Noll.*** *Power Engineering*, v. 63, May 1959, p. 91-93.

10588 Some Fundamental Considerations Relating to Advanced Rocket Propulsion Systems. Presents a general relativistic theory of rocket propulsion, applicable to either adiabatic

or diabatic jets, and to several methods for handling fuel residual. Emphasizes performance limitations imposed by both fuel energetics and power supply weight. ***John Huth. Rand Corporation, Report P-1479, Sept. 2, 1958, 16 pp .(T13 R15r Contin.)***

10589* Adolescent Engines. Orpheus. A Bristol-Siddeley lightweight medium-thrust turbojet engine. ***A. H. Wheeler. Shell Aviation News,*** 1959, no. 250, Apr., p. 7-10.

See also: **9887** (aircraft gas turbines).

INFORMATION—PREPARATION AND DISSEMINATION

10590 Mass Spectrometric Analysis. Spectral Data File Utilizing Machine Filing and Manual Searching. No machine searching of this file is necessary; all spectra having one of their 15 most significant peaks at a particular *m/e* will be grouped together in probable order of abundance. ***Fred W. McLafferty and Roland S. Gohlke. Analytical Chemistry,*** v. 31, July 1959, p. 1160-1163.

10591* Annotated Bibliography of α-Benzildioxime. 120 references presented chronologically. ***Charles V. Banks, Michael J. Maximovich, Nelson J. Fowlkes, and Peter A. Beak.*** 60 pp. 1958, Office of Technical Services, U. S. Department of Commerce, Washington, D. C. (ZQD305.k2 Un3.1a Ref.)

10592 Catalog Use Study. The purposes of the study were to: 1. Identify the demands made on the catalog by its actual users. 2. Measure the adequacy with which the catalog is meeting these demands. 3. Isolate areas in need of more thorough investigation. 4. Produce a reliable interview form and related tools. ***Vaclav Mostecky, editor.*** 86 pp. 1958. American Library Association, Chicago. (Z695 J13c Over.)

10593 Concise Dictionary of Science. This dictionary provides concise definitions of terms and concepts pertaining to *all* fields of science. Full coverage is given to the newer sciences of virology, ensymology, cytogenetics, radio-chemistry, high energy, and solid-state physics. ***Frank Gaynor.*** 546 pp. 1959. Philosophical Library, New York. (Q123 G25c)

10594* Writing for Science. The good presentation of technical information is extremely difficult. A description of the principles underlying good writing and an insight into the difficulties may help the scientific writer. ***Geoffrey Parr. Discovery,*** v. 20, May 1959, p. 199-203.

10595* How to Talk—and Listen—Better. Five key rules that will make you a better talker. ***James H. Morrison. Factory,*** v. 117, June 1959, p. 91-93.

10596* Supplement to an Engineer's Library. Guide to the Profession. An extracurricular bibliography for engineers. ***John McGowan, et al. Journal of Engineering Education,*** v. 49, no. 9, May 1959, p. 767-772.

10597 More Information Through Documentation. Describes the application of coordinate indexing to the Engineering Department technical files of E. I. duPont de Nemours & Co. ***T. W. Schwartz. Petroleum Refiner,*** v. 38, June 1959, p. 299 + 6 pages.

10598* Literature Requirements for Industrial Research. In cases where the literature is very useful, a gap usually exists between the use of literature by the research worker and the literature potentially available that is pertinent to his work. Through specifically directed activity, the technical librarian or literature specialist can do much to bridge this gap. ***Paul Seligmann. Portland Cement Association, Journal of the Research and Development Laboratories,*** v. 1, no. 2, May 1959, p. 25-29.

10599 Russian for the Scientist. This book is designed to furnish the scientist with a tool with which he may go to Russian scientific literature and extract the particular information that he seeks, be it deciphering of titles, reading of graphs, or a thorough study of articles. The material is presented in such a way as to develop a knack for recognition as well as familiarity with the basic points of grammar. ***John Turkevich and Ludmilla B. Turkevich.*** 255 pp. 1959. D. Van Nostrand Company, Princeton, N. J. (PG2111 T84r)

10600* The Distribution Function in Documentation. Explains the report distribution system used in the Air Force Office of Scientific Research of the Air Research and Development Command, where the author is Chief, Technical Information and Intelligence Division. ***John M. Hetrick. Special Libraries,*** v. 50, no. 5, May-June 1959, p. 193-195.

10601 Special Libraries Association—Its First Fifty Years, 1909-1959. Presents historical highlights of the Association's accomplishments, and contains brief resumés of the chapters and divisions and their activities together with lists of Association officers and professional award winners. ***Alma Clarvoe Mitchill, editor.*** 121 pp. 1959. Special Libraries Association, New York. (Z673 Sp31s)

10602* Integrating the Facts. It is from the same cards that perform vital day-to-day functions that the computer makes possible the reports so valuable to management. Reports on sales, salesman activities, results of special promotions, etc., are put together by having the equipment separate the desired information from the basic cards, and punch it into new cards for high-speed listing on the Tabulator. ***Joseph F. Perry. Systems,*** v. 23, no. 3, May-June 1959, p. 22-23.

10603 Fundamental Problems of Machine Translation. Discusses the potentialities of computers from the point of view of machine translation and formulates several linguistic problems that must be solved to render the machine process more efficient. ***P. S. Kuznetsov, A. A. Lyapunov, and A. A. Reformatskiy.*** *U. S. Office of Technical Services, PB* 141383T, p. 1-9. (Translated from: *Voprosy Yazykoznaniya,* v. 5, no. 5, Sept.-Oct. 1956, p. 107-111.)

10604 Experiments in Machine Translation. Certain questions of syntax in connection with machine translation from English to Russian. ***T. N. Moloshnaya.*** *U. S. Office of Technical Services, PB* 141383T, p. 48-57. (Translated from: *Voprosy Yazykoznaniya,* no. 4, 1957, p. 92-97.)

See also: **9909** (Russian biochemical abbreviations).

INSTRUMENTATION

10605 Method of Determining the Particle Dimensions of Aluminum Powder. Procedures for measuring average thickness and transverse dimensions of pigment-grade Al powders, using a single sample of 0.1 g. for both determinations. ***I. N. Varlamova and B. P. Golubev.*** *Henry Brutcher Translation No.* 4493, 4 pp. (From *Zavodskaya Laboratoriya,* v. 22, no. 1, 1956, p. 80-82.) Henry Brutcher, Altadena, Calif.

10606 Review and Evaluation of Methods of Particle Size Analysis. I. The Definition of Terms and Classification of Sizing Methods. II. Sieve Analysis. *R. F. Pilgrim.* *Department of Mines and Technical Surveys, Ottawa, Canada, Mines Branch, Information Circular IC* 106, Nov. 3, 1958, 83 pp. (TN26 C16.5i Contin.)

10607 Using Isotopes to Measure Low Pressures. Radiological vacuum gages permit measuring extremely low pressures for checking industrial and scientific laboratory equipment and in high-altitude research. This instrument is extremely compact and provides a digital output than can be used for storage or telemetering. ***G. Frederick Vanderschmidt. Electronics,*** v. 32, no. 25, June 19, 1959, p. 60-61.

10608* An Apparatus for Measuring Magnetostriction in the Temperature Range From −180 to +440 C. Describes the design and performance of the apparatus developed at the VNIIM for measuring temperature factor for magnetostriction in different metals at temperatures varying from −180 to +440 C. (*In Russian.*) Ustanovka dlia izmereniia magnitostriktsii v intervale temperatur ot −180 do +440 C. ***B. M. Ianovskiĭ, E. A. Sokolova, and V. S. Gegin.*** *Izmeritel'naia Tekhnika,* 1959, no. 4, Apr., p. 27-30.

10609 Quick-Acting Chemical Balance. Balance described is suited for use in weighings made to an accuracy of one part in 5000. ***B. O. Smith and J. W. Stevens.*** *Journal of Scientific Instruments*, v. 36, May 1959, p. 206-209.

10610 Monitored Geiger Counter X-Ray Diffractometer With Automatic Recording. Describes the equipment which produces automatically a compact photographic record of a step-scan of a powder diffraction pattern in steps of $0{\cdot}02°(2\theta)$. The specialized electronic circuits and relay-operated automatic sequence control circuits are described, together with a special automatic camera provided with various safety devices to protect the record. ***E. R. Pike and J. W. Hughes.*** *Journal of Scientific Instruments*, v. 36, May 1959, p. 212-223.

10611* Continuous Viscosity Measurement of Solutions of High Polymer Substances by Means of an Oscillation Viscosimeter. Description of a viscosimeter with electromagnetic transversal oscillations. It shows that in solutions of macromolecular substances, there are traps producing a quasi-elastic network. Molecules can slide, which explains the greater static viscosity. (*In German.*) Kontinuierliche Viskositätsmessung von Lösungen hochpolymerer Stoffe mit einem Schwingungsviskosimeter. ***W. Holzmüller and G. Winterstein.*** *Kolloid-Zeitschrift*, v. 163, no. 2, Apr. 1959, p. 126-132.

10612* The Process Measurement of Moisture. Methods and instruments for continuously monitoring chemical processes for moisture are discussed. Emphasizes the diversity of equipment necessary to make a particular determination, depending upon the nature of the measurement desired. ***Richard J. Anderson.*** *Process Control and Automation*, v. 6, May 1959, p. 201-204.

10613 Analytical Chemistry in Nuclear Reactor Technology. Particle-Size Analysis. Papers presented at Second Conference at Gatlinburg, Tennessee, on Sept. 29-Oct. 1, 1958. Includes reports on light scattering, gamma-ray absorption, sedimentation, centrifugation, electronic methods, and flying-spot microscopy. *U. S. Atomic Energy Commission, TID-7568* (Pt. 3), Apr. 1959, 101 pp. (UF767 Un3ti Contin.)

10614* The Production of Ultra-High Vacua by Means of a Diffusion Pump. The result of a measurement of the so-called ultimate prossure of a diffusion pump is often not only determined by the pump itself, but also by the additional apparatus necessary for making this measurement. An analysis is given of the gases which may be present at the pump mouth and the factors determining the pressure of those gases will be treated. A discussion of the methods which can be used for making these pressures as small as possible results in a design of a pump apparatus. With the apparatus, a pump speed at the recipient of 5-10 l./s. for the common gases is obtained and an ultimate pressure lower than 10^{-12} mm. Hg is reached. ***A. Venema.*** *Vacuum*, v. 9, no. 1, Mar. 1959, p. 54-57.

10615* A Liquid Circulation Cell for the Investigation Under the Microscope of Dyeing Processes on Textile Fibres. The cell described is extremely simple; it has two glass plates with plane and parallel surfaces, a base and a cover. A groove runs along the length of the base and the latter has a notch in which the fibers are fastened. The construction of the cell is described in detail. (*In German.*) Eine Durchflusskammer zur mikroskopischen Untersuchung von Färbungsvorgängen auf Textilfasern. ***N. Iwanow and R. Schneider.*** *Zeitschrift für Wissenschaftliche Mikroskopie und Mikroskopische Technik*, v. 64, no. 3, Mar. 1959, p. 149-157.

LUBRICATION AND FRICTION

10616* Review of Propeller Shaft Thrust Bearings. Reviews operating conditions of propeller shaft thrust bearings, present status of bearing technology and suggests areas of investigation necessary if thrust bearings are to keep up with advancing requirements of marine propulsion machinery. ***B. Sternlicht, J. C. Reid, Jr., and E. B. Arwas.*** *American Society of Naval Engineers, Journal*, v. 71, no. 2, May 1959, p. 277-289.

10617 Effect of Lubricants on Process of Friction. Cases in which surface-active lubricants increase (rather than decrease) the wear of parts in contact, and explanation of this behavior by the chemical interaction between lubricant and solid predominating over other variables. Results of friction tests measured by time to failure of (wire) specimens and weight loss of pulleys in contact with them. ***V. D. Kuznetsov, A. I. Loskutov, and L. M. Kisurina.*** *Henry Brutcher Translation No.* 4549, 6 pp. (From *Doklady Akademii Nauk SSSR*, v. 109, no. 1, 1956, p. 124-126.) Henry Brutcher, Altadena, Calif.

10618 Recent Developments in Roll Neck Bearing Design and Mounting. The multi-row cylindrical roll neck mounting consists of two separate parts, a 4-row cylindrical radial bearing for the heavy mill separating loads and a separate thrust bearing for the axial load. Describes some of the many possible multi-row and thrust bearing combinations which satisfy the most exacting mill requirements. ***E. C. Denne, Jr.*** *Iron & Steel Engineer*, v. 36, no. 5, May 1959, p. 117-126.

10619 Lubricant Behaviour in Concentrated Contact Systems—The Castor Oil-Steel System. Experiments are described in which frictional forces are measured between hardened steel surfaces lubricated with castor oil. In one series of experiments, balls of different sizes slide against a moving plane at a maximum Hertz stress of 389,000 p.s.i. (273.5 kg/mm²) over a range of speeds up to 140 cm/sec. In another experiment the frictional force is measured between rollers which roll with a small component of sliding motion, the elastic stresses being similar to those used in the first experiment. ***F. W. Smith.*** *Wear*, v. 2, no. 4, May 1959, p. 250-263.

10620 Time Effects in the Static Friction of Lubricated Rubber. The considerable increases in static friction that occur when lubricated rubber remains at rest under load are shown to be due to squeezing out of the lubricant film from between the surfaces. ***D. F. Denny.*** *Wear*, v. 2, no. 4, May 1959, p. 264-272.

10621 Statistics on Cylinder Wear in Marine Diesel Engines. Efforts to elucidate statistically the problems in connection with cylinder wear in marine diesel engines, by the use of punched cards and electronic digital computers. Further, some hypotheses concerning the causes of cylinder wear and the way to overcome it are given. ***H. D. Lees.*** *Wear*, v. 2, no. 4, May 1959, p. 273-295.

10622 Review on the Factors Influencing the Friction of Fibres, Yarns, and Fabrics. ***C. Rubenstein.*** *Wear*, v. 2, no. 4, May 1959, p. 296-310.

10623 Influence of Low Temperatures on the Lubricating Capacity of Mineral Oils. The lubrication properties of lubricant layers on metals are known to be greatly dependent on temperature. This is confirmed by testing the friction of metal surfaces lubricated with oil heated to various temperatures. ***R. M. Matveevsky.*** *Wear*, v. 2, no. 4, May 1959, p. 315-317.

See also: **10193** (lubricant compositions).

MECHANICAL ENGINEERING

10624 The Strength of Thick-Walled Cylinders. Pressure tests were carried out on thick-walled closed-ended cylinders made from a mild steel and a hardened and tempered steel, the maximum pressure reached being 94,000 lb/in. The complete theoretical behavior of the cylinders is computed from shear stress-strain data obtained from torsion tests and is shown to be in very close agreement with the experimental results. A method is given for deriving the large strain behavior of the cylinders from tension test data. When compared with the experimental results this approach gives larger errors, the theoretical values of pressure being consistently high. Ultimate pressures were calculated from two empirical expressions. ***B. Crossland, S. M. Jorgensen, and J. A. Bones.*** *ASME, Transactions, Series B, Journal of Engineering for Industry*, v. 81, no. 2, May 1959, p. 95-114.

10625 Steady-State Creep Analysis of the Weight Loadings of Furnace Tubes on Multiple Supports. Analysis of creep stress-strain relationships is made for horizontally supported furnace tubes including the effect of tube weight and internal pressure. Steady-state creep effects through the tube wall due to axially symmetrical heat input are also analyzed for these conditions. Maximum permissible tube spans are derived based on accepted criteria for creep stress and deflections. ***J. L. Jacobowitz and C. K. Mader.*** *ASME, Transactions, Series B, Journal of Engineering for Industry,* v. 81, no. 2, May 1959, p. 115-125.

10626 How to Replace Gears by Mechanisms (Linkages). A practical method is shown for designing four-bar mechanisms having a prescribed transmission ratio held within prescribed tolerances, for a limited range of motion. Such mechanisms may economically replace gears in many applications. Charts enable the designer to choose the mechanism having the best transmission angle possible. ***Kurt Hain and Gerhard Marx.*** *ASME, Transactions, Series B, Journal of Engineering for Industry,* v. 81, no. 2, May 1959, p. 126-130.

10627 Synthesis of Path-Generating Mechanisms by Means of a Programmed Digital Computer. A general method is presented for synthesizing plane, linked mechanisms obtainable from a single, closed kinematic chain. Using complex numbers and the matrix theory of linear systems, these methods have been applied to 4-link mechanisms for generating a path through up to five arbitrary points with prescribed corresponding crank rotations. The five-point synthesis is programmed for automatic computation on the IBM 650 digital computer, which determines all existing solutions (a maximum of 12 linkages), selects one on the basis of a quality index, and computes the generated path. ***Ferdinand Freudenstein and George N. Sandor.*** *ASME, Transactions, Series B, Journal of Engineering for Industry,* v. 81, no. 2, May 1959, p. 159-168.

10628 Synthesis of the Four-Bar Linkage to Match Prescribed Velocity Ratios. A method is described for synthesizing a four-bar linkage in terms of its velocity ratio at two or three positions of the input crank. The two-point synthesis problem is readily solved by either graphical or longhand mathematical techniques. The method also lends itself to computer solution for the three-point synthesis problem and also for determining the best match of a desired function over a specified range of input crank motion. ***Philip Barkan and E. J. Tuohy.*** *ASME, Transactions, Series B, Journal of Engineering for Industry,* v. 81, no. 2, May 1959, p. 169-177.

10629 Heat and Mass Transfer From a Rotating Disk. Experimentally measured mass-transfer rates from a disk rotating in an infinite environment under laminar and turbulent conditions are related to the corresponding heat-transfer process by means of an analogy method. The experimental analog is shown to eliminate difficulties associated with accurate measurements of heat-transfer coefficients. ***F. Kreith, J. H. Taylor, and J. P. Chong.*** *ASME, Transactions, Series C, Journal of Heat Transfer,* v. 81, no. 2, May 1959, p. 95-105.

10630* Asymmetrically Plate-Reinforced Circular Hole in a Uniformly End-Loaded Flat Plate. The effect of an asymmetrically placed reinforcement is to induce, in the plate and reinforcement, bending stresses which are not negligible compared with the externally applied direct stress. Reinforcements having practical dimensions can give rise to stress concentrations in the same order of magnitude as those in a similarly loaded plate containing an unreinforced hole. Data was obtained which enables the designer to determine quickly the stress distributions associated with reinforcements and plates having a reasonably wide range of dimensions. ***Raymond Hicks.*** *Aeronautical Quarterly,* v. 10, pt. 2, May 1959, p. 183-198.

10631* Pressure Vessels. A study of some successful materials and processes. ***John P. Kushnerick.*** *Aircraft and Missiles Manufacturing,* v. 2, May 1959, p. 35-38.

10632* Cylindrical Shell Analysis Simplified by Beam Method. The "Beam Method" of analyzing cylindrical shells is briefly explained. Formulas are presented for analyzing single shells without edge beams and interior barrels of multiple shells. A numerical example illustrates use of formulas. Method applies to continuous as well as simply supported shells. ***James Chinn.*** *American Concrete Institute, Journal,* v. 30, *ACI Proceedings,* v. 55, no. 11, May 1959, p. 1183-1192.

10633* Rake Correction in the Measurement of Parallel External and Internal Screw Threads. Formulae are derived for calculating the rake correction for a ball seated in the helical groove of an internal screw thread and a ball or cylinder in an external thread. The equivalence of a ball and cylinder in an external thread is discussed. A simple approximation formula and a precise formula are derived for determining when double contact between the cylinder and thread flank occurs. ***R. S. Marriner and J. G. Wood.*** *Institution of Mechanical Engineers, Proceedings,* v. 172, no. 19, 1958, p. 675-684.

10634 Designing for Human Strength. General facts concerning human strength. Relationship of muscular ability of equipment operators and handlers to practical design features of machinery. ***Joseph L. Seminara.*** *Machine Design,* v. 31, May 28, 1959, p. 96-99.

10635 Designing for Balance. Part design, assembly practices, unbalance correction, and balancing tolerances in rotating parts and assemblies. ***Robert R. Zenk.*** *Machine Design,* v. 31, May 28, 1959, p. 102-109.

10636 Planetary Gear Drives. Analytical problems in obtaining efficient gear trains. ***Eugene I. Radzimovsky.*** *Machine Design,* v. 31, June 11, 1959, p. 144-153.

10637* Hydraulic Drives in Outline. III. Representative Hydrostatic Transmissions. *Oil Engine and Gas Turbine,* v. 27, May 1959, p. 14-17.

10638* Hydraulic Loading Equipment for Structural Testing. Design features, performance characteristics, and applications for a system of hydraulic loading equipment providing accuracy of load measurement within plus or minus one to two per cent. ***Eivind Hognestad.*** *Portland Cement Association, Journal of the Research and Development Laboratories,* v. 1, no. 2, May 1959, p. 30-37.

10639 New Equations Locate Dwell Position of 3-Gear Drives. Basic components of 3-gear drive and patterns of motion. Center-distance equation and sample problem. ***J. Hirschhorn.*** *Product Engineering,* v. 30, no. 23, June 8, 1959, p. 80-81.

10640 Sealing Problems of High Speed, High Altitude Aircraft and Guided Missiles. Environmental extremes; types of hydraulic fluids; static and dynamic seals; available seal materials; O-ring design studies. ***E. G. Ellis.*** *Scientific Lubrication,* v. 11, May 1959, p. 10 + 3 pages.

10641 Thermal Buckling of Circular Cylindrical and Conical Thin-Walled Shells. Analysis of temperature and thermal stress distribution, buckling stress criterion, and experimental results. The entire scope of the investigation falls within the framework of linear elastic theory. ***David Abir, et al.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 58-104, Apr. 1958, Sections individually paged. (TL507 Un3.18w Vis.)

10642 Vibration and Impact. Free vibration; vibratory systems commonly found in machinery; damping; steady forced vibration; impact; nonlinear vibration; measurement, instruments and analogs; systems with two degrees of freedom; numerical computation of natural frequencies for systems with many degrees of freedom; waves; vibrating beams and related subjects; analysis of control systems; fatigue. ***Ralph Burton.*** 310 pp. 1958. Addison-Wesley Publishing Company, Reading, Mass. (TA355 B95r)

See also: **10743** (brittle fracture in steel structures).

METALLURGY

10643* The 200-Series Stainless Steels. Use of 200 series stainless steel in the marine industry. ***Burton I. Edelson.*** *American Society of Naval Engineers, Journal,* v. 71, no. 2, May 1959, p. 233-240.

10644 Service Temperature of Steel for Flat Springs in Labyrinth Seals of Steam Turbines Increased to 640° C (1185°F). Fabrication and properties of spring steels for service at 640 C over a period of 10,000 hrs. ***T. I. Volkova.*** *Henry Brutcher Translation No.* 4249, 7 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 6, June 1958, p. 21-25.) Henry Brutcher, Altadena, Calif.

10645 Physical-Chemical Properties and Fields of Application of Rare Metals. Includes classification of rare metals, based on similarity in physico-chemical properties, production processes, and joint occurrence in the earth's crust. ***E. M. Savitskii.*** *Henry Brutcher Translation No.* 4313, 29 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 8, Aug. 1958, p. 2-13.) Henry Brutcher, Altadena, Calif.

10646 Bureau of Ships Conference. Hy-80 Steel Fabrication in Submarine Construction. A seminar of 15 papers, held at United States Naval Research Laboratory, July 29-30, 1958, of interest to production personnel engaged in fabrication of submarine hulls from HY80 steel as well as to engineers and architects, in that it presents potential as well as new developments in weld fabrication materials and methods. 134 pp. 1958. United States Naval Research Laboratory, Washington, D. C. (TS227 Un3.7h Over.)

10647 Soviets Push Ambitious Aluminum Plans. Irkutsk, in Siberia, will be the site of the world's largest alumina-aluminum works. ***F. H. Baer.*** *Engineering and Mining Journal*, v. 160, May 1959, p. 102-105.

10648 The Fall Convention of the French Metallurgical Society; October 20 to 25, 1958. A series of abbreviated texts of the 12 reports presented by the Iron Metallurgical Research Institute and covering such subject matter as intergranular absorption, brittle fracture in mild steel, desulfuring cast iron, and N precipitation in pure Fe-N alloys. (*In French.*) Communications aux Journées d'Automne de la Société Française de Métallurgie. Institute de Recherches de la Sidérurgie, Saint-Germain-En-Laye, France. 1958, Sections individually paged. (TN602 In7c Vis.)

10649 Two New Superalloys for High Temperatures. The alloys, designated D-979 and AF-71, were developed primarily for aircraft gas turbines, but are also suggested for use in missiles, airframes and commercial turbines. Both of the superalloys are precipitation hardening and are available in the form of billet, bar, wire, sheet, strip, and foil. *Materials in Design Engineering*, v. 49, May 1959, p. 150-151.

10650* High Uranium Content Alloys. Description of UMo alloys possessing a homogeneous metallic lattice and able to withstand high temperatures with advantageous amounts of irradiation. (*In French.*) Alliages d'uranium à forte teneur. ***G. Cabane.*** *Métaux Corrosion-Industries*, v. 34, Feb. 1959, p. 49-57.

10651 Modern Steels and Their Properties. Carbon and Alloy Steel Bars. Contains a number of short elementary articles on current metallurgical developments, together with several revised tables of useful data. A glossary of some of the most common terms used in heat-treating and testing is also included. Handbook 268-C. 4th Ed. 241 pp. 1958. Bethlehem Steel Company, Bethlehem, Pa. (TN730 B46m4)

10652* The Selection of Stainless Steels for Use in Liquid Hydrogen Bubble Chambers. Experimental results connected with the magnetic properties and stability of stainless austenitic steels, obtained in the course of tests for selection of steel to be used in construction of liquid H bubble chambers, which should be nonmagnetic at low temperatures. ***Pierre Amiot.*** *Nuclear Instruments and Methods*, v. 4, Mar. 1959, p. 118 + 1 page.

10653 Nuclear Metallurgy. v. V. Ceramic Base Elements; Metal Base Fuels and Jacket Components. A symposium on the fabrication of fuel elements. 84 pp. 1958. American Institute of Mining, Metallurgical, and Petroleum Engineers, New York. (TN697 Am35n5)

10654 Pressure Bonding of Zircaloy-Clad Flat-Plate Uranium-Dioxide Fuel Elements. A solid-state bonding technique involving the use of gas pressure at elevated temperatures is being investigated for the preparation of Zircaloy-clad flat-plate U-dioxide fuel elements. In this procedure, the fuel-element components, consisting of a compartmented Zircaloy picture frame, U-dioxide fuel plates, and Zircaloy cladding plates, are assembled into a container that is evacuated and sealed. This sealed assembly is subjected to a He pressure of 10,000 psi at a temperature of about 1500 F in a high-pressure autoclave. The pressure brings the components into intimate contact, and a solid-state bond is attained through diffusion. The U dioxide is coated with graphite to prevent reaction between the fuel and Zircaloy cladding. ***S. J. Paprocki, E. S. Hodge, and D. C. Carmichael.*** Paper from "Nuclear Metallurgy. v. V. Ceramic Base Elements; Metal Base Fuels and Jacket Components", American Institute of Mining, Metallurgical, and Petroleum Engineers, New York. 1958. p. 13-24. (TN697 Am35n5)

10655 Plutonium Metallurgy in Russia. One field in which the Russians have worked almost alone—an academic one—was the investigation of the magnetic properties of plutonium alloys and intermetallic compounds. ***M. B. Waldron.*** *Nuclear Power*, v. 4, May 1959, p. 111-112.

10656 Before Tackling the Refractory Metals. Cb, Ta, W, and Mo show important differences in properties—and these must be considered in fabrication techniques, such as welding. ***Alan F. Busto.*** *Product Engineering*, v. 30, no. 21, May 25, 1959, p. 43-45.

10657 The Use of Radioactive Isotopes. II. Metallurgical Applications. In the first part, a brief survey of the production and properties of radioisotopes, best methods available for detecting radiations, and accuracy of these methods was made. These general principles were then applied to problems in the engineering industry; this article considers some of the many metallurgical applications: the blast furnace, wear of blast-furnace lining, refining and casting, measurement of impurity content, diffusion studies, segregation and surface defects, and friction and wear. ***C. G. Clayton.*** *Research*, v. 12, May 1959, p. 172-178.

10658 Steel in the Soviet Union. The report of the American Steel and Iron Ore Delegation's visit to the Soviet Union, May and June, 1958. This comprehensive report of their visit is compiled from individual reports made by the 19 members of the delegation. 376 pp. 1959. American Iron and Steel Institute, New York. (TS304.R9 Am35s)

10659* On the Recent High-Tensile Steels. I. Technical review. (*In Japanese.*) ***Masayoshi Yamaki.*** *Tetsu to Hagané (Journal of the Iron and Steel Institute of Japan)*, v. 45, no. 4, Apr. 1959, p. 438-450.

10660 Development of Niobium-Base Alloys. Flow and fracture studies indicate that the ductile to brittle transition of niobium is little affected by oxygen content in the range 0.01 to 0.1% O_2. Strain-hardening and strain aging in niobium were studied. The recrystallization behavior of electron-beam melted niobium was studied in detail. Creep-rupture data were obtained on electron-beam melted niobium at (871 C) 1600 F and (982 C) 1800 F. ***Richard T. Begley.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 57-344, pt. 2, Mar. 1959, 180 pp. (TL507 Un3.18w Vis.)

10661 Selection and Evaluation of Rare or Unusual Metals for Application to Advanced Weapons Systems. I. A Literature Survey. Survey of the rare earth elements, Hf, Rh, and Ru. Includes data on the abundance and distribution of the elements, the methods of recovery from ores and purification, the reduction to metal, and the physical, chemical, and mechanical properties of the elements and their important compounds. ***Bernard Love.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 57-666, June 1958, 174 pp. (TL507 Un3.18w Vis.)

10662* Whisker-Like Crystals Having Strength Close to the Theoretical. Production, orientation, structure and shape of whisker-like crystals of Cu, Ag, Fe, Ni, Co, and Pt growth mechanism; deformation, and yield data compared with those of common crystal; creep, effects of testing temperature, effects of size and surface quality on strength; other properties. (*In Russian.*) Nitevidnye kristally s prochnost'iu, blizkoĭ k teoreticheskoĭ. ***E. M. Nadgornyi, Iu. A. Osip'ian, M. D. Perkas, and***

V. M. Rozenberg. Uspekhi Fizicheskikh Nauk, v. 67, no. 4, Apr. 1959, p. 625-662.

See also: **10867** (UO_2-liquid metal slurry reactor).

METALS—CORROSION

10663 Study of Action of Superheated Steam Upon Rupture Strength of Austenitic Steel. ***E. A. Davidovskaya and L. P. Kestel'.*** *Henry Brutcher Translation No.* 4318, 8 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 8, Aug. 1958, p. 29-33.) Henry Brutcher, Altadena, Calif.

10664 High-Temperature Oxidation of Nickel in Sulfur Dioxide. Study of kinetics of oxidation of Ni in sulfur dioxide at high temperatures, and of phase and chemical compositions of the resulting scale. ***V. V. Ipat'ev and D. V. Zheltukhin.*** *Henry Brutcher Translation No.* 4448, 6 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 12, Dec. 1958, p. 42-45.) Henry Brutcher, Altadena, Calif.

10665* Effects of Inhibitors on Iron Corrosion. Urotropine acts as an anodic inhibitor in neutral solution, and as a cathodic inhibitor in acid solution. Ethyl quinoline iodide scarcely acts in a neutral medium, but is a powerful anodic inhibitor in an acid medium and to a lesser degree a cathodic inhibitor. In each case studied, the inhibiting anodic effect rests on a decrease of the strength of the local current. (*In French.*) Influence des inhibiteurs sur la corrosion du fer. ***H. Grubitsch and T. Sneck.*** *Corrosion et Anticorrosion*, v. 7, no. 4, Apr. 1959, p. 153-161.

10666* The Oxidation of Hot-Pressed Titanium Carbide and Titanium Boride in the Temperature Range 300°-1000°C. The oxidation characteristics of pure hot-pressed TiC and TiB_2 were studied in the range 300-1000 C. Titanium carbide shows a very marked peak in the rate of oxidation at ~ 450 C, the oxidation product at this temperature being anatase (TiO_2), which is powdery and nonadherent; the oxidation follows a linear law. ***N. F. MacDonald and C. E. Ransley.*** *Powder Metallurgy*, no. 3, 1959, p. 172-180.

See also: **10308** (paint film thickness for corrosion protection of hot-rolled steel).

METALS—EXTRACTION AND REFINING

10667 Flow Pattern in Continuous Casting Process. Simulation of hydromechanics of pouring devices; modeling of motion of metal in continuous casting. ***K. I. Afanas'eva and T. P. Iventsov.*** *Henry Brutcher Translation No.* 4337, 14 pp. (From *Stal'*, v. 18, no. 7, 1958, p. 599-604.) Henry Brutcher, Altadena, Calif.

10668 Vacuum Arc Melting of Molybdenum. Brief outline of Russian development work on consumable-electrode vacuum-arc melting of Mo. ***A. S. Stroev, A. M. Ivanov, and E. S. Ovsepyan.*** *Henry Brutcher Translation No.* 4366, 7 pp. (From a Collection of Papers Entitled *Primenenie Vakuuma v Metallurgii*, 1958, p. 62-65.) Henry Brutcher, Altadena, Calif.

10669 Kinetics and Mechanism of Reduction of Chromium Oxide by Carbon in Vacuum. ***A. A. Vertman and A. M. Samarin.*** *Henry Brutcher Translation No.* 4375, 18 pp. (From a Collection of Papers Entitled *Primenenie Vakuuma v Metallurgii*, 1958, p. 132-146.) Henry Brutcher, Altadena, Calif.

10670 A Vacuum Process for the Production of Ductile Vanadium. Technique developed for production of V metal by reduction with C in vacuum, below the melting point of V. ***A. Yu. Polyakov.*** *Henry Brutcher Translation No.* 4376, 11 pp. (From a Collection of Papers Entitled *Primenenie Vakuuma v Metallurgii*, 1958, p. 147-154.) Henry Brutcher, Altadena, Calif.

10671 Stock Distributor for Blast Furnaces. ***A. S. Ayukov.*** *Henry Brutcher Translation No.* 4455, 3 pp. (From Russian Patent No. 100,875, Class 18 a, °VI, Jan. 14, 1954.) Henry Brutcher, Altadena, Calif.

10672 Kinetics of Steel Making. Carbon elimination; present status of knowledge with special reference to rate-determining step. Dephosphorization; thermodynamics and kinetics; rate in basic converter, open-hearth furnace and rotor. ***L. von Bogdandy, W. Dick, and I. N. Stranski.*** *Henry Brutcher Translation No.* 4473, 27 pp. (From *Archiv f. d. Eisenhüttenwesen*, v. 29, no. 6, 1958, p. 329-337.) Henry Brutcher, Altadena, Calif.

10673 Measurement of Small Vapor Pressures at High Temperatures. V. Partial Pressures of the Components in the Iron-Phosphorus Systems. Numerical data for calculations of transfer of P in blast furnace process and distribution of P between metal and slag in steelmaking. ***A. A. Granovskaia and A. P. Lyubimov.*** *Henry Brutcher Translation No.* 4486, 6 pp. (From *Zhurnal Fizicheskoi Khimii*, v. 27, no. 10, 1953, p. 1443-1445.) Henry Brutcher, Altadena, Calif.

10674 Rating of Iron Ores From the Metallurgical Standpoint. Importance of slag-forming substances contained in Fe ores, aside from the latters' Fe content, for economical production of pig iron. ***W. Zimmer.*** *Henry Brutcher Translation No.* 4497, 10 pp. (From *Neue Hütte*, v. 3, no. 4, 1958, p. 233-235.) Henry Brutcher, Altadena, Calif.

10675 Use of Oxygen in the Production of Pig Iron in Low-Shaft Furnaces. Studies of production of foundry iron in low-shaft furnaces with oxygen-enriched blast; experiments in a pilot unit. ***K. Säuberlich, H. Grohmann, and G. Richter.*** *Henry Brutcher Translation No.* 4498, 19 pp. (From *Neue Hütte*, v. 3, no. 4, 1958, p. 225-232.

10676 Changes in Blast-Furnace Process When Working on Fluxed Sinter. ***N. N. Babarykin and F. A. Yushin.*** *Henry Brutcher Translation No.* 4500, 23 pp. (From *Stal'*, v. 18, no. 12, 1958, p. 1057-1065.) Henry Brutcher, Altadena, Calif.

10677 Comment on Ayukov's Paper on a New Design of Stock Distributor. Methods to improve the blast-furnace top distribution system. ***V. P. Mishchenko.*** *Henry Brutcher Translation No.* 4509, 5 pp. (From *Stal'*, v. 18, no. 1, 1958, p. 22-23.) Henry Brutcher, Altadena, Calif.

10678 Stirring of Open-Hearth Steel Baths With a Rotating Magnetic Field. Preconditions to be met in magnetic mixing of steel baths in openhearth furnaces: setting up of current-carrying conductors of stator winding and insertion of asbestos packings in metal framework of furnace. ***G. A. Ostroumov.*** *Henry Brutcher Translation No.* 4511, 12 pp. (From *Stal'*, v. 18, no. 11, 1958, p. 990-1002.) Henry Brutcher, Altadena, Calif.

10679 Air Cooling of Bottom of No. 2 Blast Furnace. Causes of breakouts of iron experienced in the past. Study of a bottom breakout by use of radio-isotopes in the foundation. Rebuilding design and experience. ***N. V. Krepyshev.*** *Henry Brutcher Translation No.* 4550, 13 pp. (From *Metallurg*, no. 11, Nov. 1958, p. 3-8.) Henry Brutcher, Altadena, Calif.

10680 Practical Fundamentals of Large-Scale Degassing of Rolling and Forging Steels by the Vacuum Lifter Process. ***F. Harders, H. Knuppel, and K. Brotzmann.*** *Henry Brutcher Translation No.* 4552, 17 pp. (From *Stahl und Eisen*, v. 79, no. 5, 1959, p. 267-272.) Henry Brutcher, Altadena, Calif.

10681 Shrinkage Phenomena in Continuous-Cast Steel. Differences in contraction between conventionally cast ingots and continuously-cast billets. ***V. S. Rutes and V. A. Leites.*** *Henry Brutcher Translation No.* 4554, 15 pp. (From *Liteinoe Proizvodstvo*, v. 9, no. 12, 1958, p. 10-12.) Henry Brutcher, Altadena, Calif.

10682 Vacuum Pouring of Ingots for Heavy Forgings. I. The method and equipment employed for vacuum pouring of

ingots for heavy forgings are described and illustrated. ***J. H. Stoll.*** *Industrial Heating*, v. 26, May 1959, p. 949 + 8 pages.

10683 Refining Liquid Pig Iron in Electric Arc Furnaces. The projected expansion of steel production in Switzerland has led to investigation of the possibilities of using local high-P ores in electric arc furnaces. Trials are described using up to 70% total charge-weight of low- and high-P pig irons, in 12- and 40-ton capacity arc furnaces, with ore as the main refining agent. ***R. Durrer and G. Heintze.*** *Iron and Steel Institute, Journal*, v. 192, pt. 1, May 1959, p. 13-25.

10684 Recent Developments in Oxygen Steelmaking in North America. The paper describes briefly the most important recent trends and advances that characterize the application of oxygen in making Fe and steel in North America. The most immediately significant applications are: (a) the evolution of a workable practice for open-hearth heats using O through the roof; (b) the growth of the basic O steel process; (c) the use of O in electric-arc furnaces; and (d) a growing concern over the potentialities of O enrichment to produce more hot metal from existing blast-furnaces. The subjects of hot metal pretreatment and direct reduction of ore are also considered insofar as O is involved. ***J. M. Gaines.*** *Iron and Steel Institute, Journal*, v. 192, pt. 1, May 1959, p. 55-60.

10685 Vacuum Casting of Steel. The hydrogen content of degassed molten steel is of the order of 2 to 3 cm^3/100g; this content shortens the heat-treatment period of the forgings and leads to improved structures, especially in ultrasonic tests. ***J. Levaux and M. Nepper.*** *Iron and Steel Institute, Journal*, v. 192, pt. 1, May 1959, p. 77-80.

10686* Conversion of High-Phosphorus Cast Iron in a Hydrogen Blast Converter. When an upper H blast is applied, active basic slag, conditioned by P_2O_5, is formed at the beginning of the blowing process (with introduction of 15% lime); there is early dephosphorization and the metal obtained has less than 0.1% phosphorus content when the C concentration is of the order of 1 to 1.5%. (*In Russian.*) Peredel vysokofosforistogo chuguna v konvertere s kislorodnym dut'em. ***V. I. Bantizmanskii, et al.*** *Nauchnye Doklady Vysshei Shkoly, Metallurgiia*, 1959, no. 1, p. 28-33.

10687 The Floating Zone Process. This article describes the process by which material can be zone refined and grown into single crystals without a crucible container. The principles of the process are outlined and some of the experimental methods are described, with particular reference to semiconductor Si; the application of the process to metals is also included. This is the eighth article in the series on semiconductors. Three others will follow: optical and other devices, and intermetallic compounds with particular reference to bismuth telluride. ***W. Bardsley.*** *Research*, v. 12, May 1959, p. 183-187.

10688* Study of the Hydrodynamics of Molten Steel at Tapping or Teeming. II. Effect of the Degree of Nozzle Opening and Deformation on the Jet Condition. (*In Japanese and English.*) ***Yosaku Koike and Yōzō Muto.*** *Tetsu to Hagane (Journal of the Iron and Steel Institute of Japan)*, v. 45, no. 4, Apr. 1959, p. 404-409.

See also: **9998** (wear of blast furnace lining); **9999** (basic steel converters); **10108** (steel analysis in electric furnaces); **10946** (metallic Ni from nickel oxide).

METALS—FINISHING, POLISHING, AND CLEANING

10689 Electromechanical Burnishing of Metals. Variation of surface hardness of quenched steel with current. Variation of depth of surface hardness with number of passes. Microstructure of burnished surface layer. Beneficial effect of electromechanical burnishing on wear resistance and promising applications. ***B. M. Askinazi.*** *Henry Brutcher Translation No.* 4359, 7 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 9, Sept. 1958, p. 49-53.) Henry Brutcher, Altadena, Calif.

METALS—FOUNDRY PRACTICE

10690 What Is "High-Quality" Cast Iron? The search for stronger, lighter parts demands high-quality cast iron for most applications, and there is less and less room for poor cast iron. If cast iron is to compete with Al, it must be further improved. ***John Obrebski.*** *American Machinist*, v. 103, May 4, 1959, p. 104-107.

10691* Feeding Casting Under Pressure. Investigations of shape and position of shrinkage cavities in gravity and atmospheric feeder heads permitted to evaluate the advantages of pressure exerted in the feeder head upon the efficiency of feeding and also on the quality of the produced castings. A new method was found for determination of velocity of metal solidification. (*In Polish.*) Zasilanie odlewów pod ciśnieniem. ***Stanisław Teodor Jaźwinski.*** *Archiwum Hutnictwa*, v. 4, no. 1, 1959, p. 45-62 + 2 plates.

10692* Cupola Botting Materials and Their Relation to Casting Defects. The composition and preparation of botting material is a somewhat haphazard process in many foundries, and the use of low fusion point clays (1,250 - 1,400 C) can lead to casting defects. These defects are due to entrapment of fused dross in the metal stream. A feature which may be characteristic of the dross defect is the inclusion of minute metal beads in the fused silicate mass. Detailed investigation has been made of 26 botting clay mixtures used by different foundries. ***A. D. Morgan.*** *B.C.I.R.A. Journal of Research and Development*, v. 7, no. 11, Apr. 1959, p. 638-643 + 5 plates.

10693* A Rotary Sampling Machine for the Sampling of Cast Iron. Tests with the rotary sampling machine show that this machine gives satisfactory representative samples of cast Fe which are particularly suitable for C and S determinations. Difficulty is sometimes experienced in dissolving the samples for determination of Si, Mn, and P, and suitable modifications to the solvent acids are described. White, grey, and nodular graphite irons can be sampled. The machine offers a considerable saving in time compared with conventional sampling methods. ***H. Green.*** *B.C.I.R.A. Journal of Research and Development*, v. 7, no. 11, Apr. 1959, p. 644-650 + 2 plates.

10694 Effect of Pressure of Inert Gas Atmosphere in Melting Furnace on Gas Content of Metal. Melting of alloys in inert gas atmospheres where melting in vacuum is not feasible. ***D. S. Kamenetskaya and A. N. Zelenov.*** *Henry Brutcher Translation No.* 4353, 5 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 9, Sept. 1958, p. 27-28.) Henry Brutcher, Altadena, Calif.

10695 Behavior of Liquid Iron and Steel in High Vacuum. Comprehensive study of behavior of various companion elements of Fe during vacuum melting at 0.00001 to 0.001 mm. Hg in crucibles made of different materials. High-purity iron metals; crucible materials causing an increased or decreased O content; deoxidation constant for alumina and zirconia crucibles. ***W. A. Fischer and A. Hoffman.*** *Henry Brutcher Translation No.* 4440, 31 pp. (From *Archiv f. d. Eisenhüttenwesen*, v. 29, no. 6, 1958, p. 339-349.) Henry Brutcher, Altadena, Calif.

10696 "Shot" Injection of Charge and Alloying Additions Into Cupolas. Description of machine and procedure for the discontinuous injection of principal and alloying components of charge into shaft furnaces such as cupolas. ***A. Rexroth.*** *Henry Brutcher Translation No.* 4468, 12 pp. (From *Giesserei*, v. 45, no. 15, 1958, p. 417-420.) Henry Brutcher, Altadena, Calif.

10697 On the Desulfurization of Liquid Iron With Magnesium. Use of S-35 to study kinetics and nature of desulfurization. Mechanism of transfer of S from metal to fumes vs. slag during the inoculation of cupola iron with Mg. ***V. I. Lakomskii.*** *Henry Brutcher Translation No.* 4519, 5 pp. (From *Liteinoe Proizvodstvo*, v. 10, no. 11, 1958, p. 18.) Henry Brutcher, Altadena, Calif.

10698 Vacuum Arc Melting and Casting of Titanium. ***R. W. Huber, E. J. Chapin, and I. R. Lane, Jr.*** *Foundry*, v. 87, June 1959, p. 88 + 5 pages.

10699 Causes and Mechanics of the Scum Defect. Deoxidizers are the source of the material which forms the scum defect, shallow depressions in steel castings. Article describes

factors which influence formation of the defective areas and suggests some means of combating them. ***G. J. Vingas and J. B. Caine.*** *Foundry*, v. 87, June 1959, p. 94 + 3 pages.

10700* Investigation Concerning Mold Coatings. Shows reasons why coatings based on coal tar pitch have unsatisfactory properties. Coal tar pitch has such a low content of volatile matter that the development of gas during casting is insufficient and the coating fails to fulfill its purpose, because it does not prevent adherence of the ingot skin. In a search for better mold coatings, a number of products of the natural oil and coal tar industry, bakelite resins, and other materials were tested. (*In Czech.*) Vyskum kokilovych nateru. ***Lubomir Smrha and Slavoj Kubena.*** *Hutnicke Listy*, v. 14, no. 4, Apr. 1959, p. 361-368.

10701* Making Precision Castings for Commercial Applications. Production of precision castings by the lost wax method, for commercial applications. Among the more important features of the Picast process, as it is known, is the fact that the wax patterns are attached to cylindrical runners known as sumps, which form deep cups in the completed molds. Castings for textile machinery. *Machinery (London)*, v. 94, May 6, 1959, p. 1027-1034.

METALS—HEAT TREATMENT

10702* Graphical Determination of the Heating Time of Electrical Reheating Furnaces for Aluminum. Article describes development of an alignment chart for determination of heating time of electrical reheating furnaces for aluminium with consideration of required temperature of the charge and given values of the temperature of the circulating air, of the heat transfer coefficient and charge weight per meters square of the heated surface of charge. (*In German.*) Graphische Bestimmung der Wärmzeit elektrisch beheizter Wärmöfen für Aluminium. ***K. Kudrass.*** *Aluminium (Dusseldorf)*, v. 35, May 1959, p. 258-260.

10703 Localized [Induction] Heat Treating of Electro-Slag Welds. ***V. N. Novikov, I. E. Tutov, and A. I. Kondrashev.*** *Henry Brutcher Translation No.* 4320, 9 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 8, Aug. 1958, p. 38-43.) Henry Brutcher, Altadena, Calif.

10704 Interaction Between Some Sulfidizing Salts and Iron or Steel. Study of various salts for their performance as sulfidizing baths for iron and steel articles. ***A. V. Kriulin.*** *Henry Brutcher Translation No.* 4399, 7 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 10, Oct. 1958, p. 58-62.) Henry Brutcher, Altadena, Calif.

10705 Quenching With Water/Air Mixtures. Quenching power of various mixtures to obtain quantitative indices for controlling the quenching of heavy-section steel. Hardenability; possibility of predicting the results of heat treating under known conditions of quenching from TTT curves or the results of the end-quench test. ***M. E. Blanter, N. A. Kulakov, I. M. Sergeichev, T. A. Mikhin, and S. D. Fainbron.*** *Henry Brutcher Translation No.* 4446, 9 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 12, Dec. 1958, p. 29-35.) Henry Brutcher, Altadena, Calif.

10706 Determination of the Depth of the Decarburized Zone [On Steel] by X-rays. Development of an X-ray method for determination of bark thickness and distribution of C in it, based on the fact that the c/a ratio and the corresponding doublet distance for martensite increase with the C content. Recommended procedures for determining C contents above and below 0.6%. ***M. D. Perkas.*** *Henry Brutcher Translation No.* 4507, 5 pp. (From *Zavodskaya Laboratoriya*, v. 22, no. 12, 1956, p. 1458-1460.) Henry Brutcher, Altadena, Calif.

10707 Determination of Case Carbon Content on Carburized Steel by an X-ray Method. Advantages of use of X-rays for carbon determination on carburized steel over chemical methods. ***M. D. Perkas.*** *Henry Brutcher Translation No.* 4512, 5 pp. (From *Zavodskaya Laboratoriya*, v. 22, no. 9, 1956, p. 1061-1063.) Henry Brutcher, Altadena, Calif.

10708 Heat Treating the Stainless Steels. I. Discusses effects of various atmospheres as related to design of heat treating furnaces, and each metallurgical group or type of stainless. ***S. W. Cole.*** *Industrial Heating*, v. 26, May 1959, p. 908 + 4 pages.

10709* Chemical Processes Occurring in Saltpeter Baths During the Thermal Treatment of Steel. Tests proved that saltpeter baths can be used in the thermal treatment of steel and showed the ways to regenerate aged baths, consisting in removing the ferrates, perferrates and manganates of alkali metals from the sphere of reaction. (*In Russian.*) Khimicheskie protsessy proiskhodiashchie v selitrovykh vannakh pri termicheskoi obrabotke stali. ***P. Ia. Iakovlev.*** *Nauchnye Doklady Vysshei Shkoly, Metallurgiia*, 1959, no. 1, p. 233-238.

10710* The Design of Wire Hardening Furnaces. ***Helmut Junker.*** *Wire*, no. 40, Apr. 1959, p. 52-54.

See also: **10307** (nitriding of special steels); **10793** (induction hardening of steels); **10802** (ultrasonic waves in precipitation hardening and tempering).

METALS—MECHANICAL AND PHYSICAL PROPERTIES

10711* Contribution to the Work Hardening and Removal of Work Hardening of Aluminium and Its Alloys. Effect of working conditions (degree of working, temperature, speed, type of working, alloy), as well as the effect of foreign elements in connection with their uneven distribution due to their different thermic history. (*In German.*) Beitrag zur Verfestigung und Entfestigung von Aluminium und Aluminium legierungen. ***F. Erdmann-Jesnitzer and H. Hadamovsky.*** *Aluminium (Dusseldorf)*, v. 35, May 1959, p. 248-257.

10712 Resistance to Relaxation of Spring-Steel Strip at Room Temperature. Study of relaxational behavior of three spring steels in the form of strip, at room temperature under high bending loads. ***V. Ya. Zubov and S. V. Grachev.*** *Henry Brutcher Translation No.* 4218, 7 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 5, May 1958, p. 20-23.) Henry Brutcher, Altadena, Calif.

10713 Non-Uniformity of Creep. Recording of differences in rate and amount of creep among different zones (10 mm) of specimens of Ni-Mo and Fe-Mo alloys, within a wide temperature range. ***M. G. Lozinskii, M. B. Guterman, and E. I. Antipova.*** *Henry Brutcher Translation No.* 4245, 6 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 6, June 1958, p. 6-9.) Henry Brutcher, Altadena, Calif.

10714 Effect of Plastic Deformation on High-Temperature Strength of [Nickel] Alloy EI 437. ***S. T. Kishkin, A. A. Klypin, and A. M. Sulima.*** *Henry Brutcher Translation No.* 4248, 5 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 6, June 1958, p. 18-21.) Henry Brutcher, Altadena, Calif.

10715 High-Temperature Strength of Copper-Chromium and Copper-Nickel Alloys. Study of static tensile properties, creep behavior, and corrosion resistance of a wrought 99.1% Cu, 0.73% Cr, 0.11% Fe, 0.02% Zn alloy after various heat-treatments and comparison with technical-purity Cu. ***A. P. Simakovskii.*** *Henry Brutcher Translation No.* 4253, 9 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 6, June 1958, p. 41-47.) Henry Brutcher, Altadena, Calif.

10716 Study of Ductile-Brittle Transition Temperature of Some Low-Alloy Steels. Search for inexpensive structural steels resistant to embrittlement at subzero temperatures. Effect of heat treating subsequent to hot working, and of P content (0.015 to 0.05% P) upon critical transition temperature weldability tests. ***A. P. Sanina and M. M. Timofeev.*** *Henry Brutcher Translation No.* 4324, 5 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 8, Aug. 1958, p. 57-58.) Henry Brutcher, Altadena, Calif.

10717 Study of Impact Fatigue Strength. Difference between impact fatigue strength and ordinary fatigue strength values obtained on two low-alloy structural steels. ***N. N.***

Davidenkov and E. I. Belyaeva. *Henry Brutcher Translation No.* 4349, 6 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 9, Sept. 1958, p. 12-15.) Henry Brutcher, Altadena, Calif.

10718 Impact Strength of Low-Alloy Structural Steel SKhL-4 at Subzero Temperatures After Various Heat Treatments. Experimental study of a 0.12% C, 0.77 Mn, 0.9 Si, 0.84 Cr, 0.56 Ni, 0.024 P and S each, structural steel for effect of various heat treating practices on tough-to-brittle transition temperature. How to minimize danger of brittle failure. ***L. A. Gaivoronskii, E. V. Shustitskaya, and K. V. Ponov.*** *Henry Brutcher Translation No.* 4360, 4 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 9, Sept. 1958, p. 54-55.) Henry Brutcher, Altadena, Calif.

10719 Study of Failure of Steel in Creep. Study of nature of failure in stress-concentration zones of various low and high-alloy steels under triaxial tension and creep conditions. ***I. I. Trunin and I. L. Mirkin.*** *Henry Brutcher Translation No.* 4429, 13 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 11, Nov. 1958, p. 25-32.) Henry Brutcher, Altadena, Calif.

10720 Some Magnetic Properties of Present-Day Permanent-Magnet Materials and Their Commercial Uses. Demagnetization curves for Ticonal-G, and Ferroxdure-2. Design of permanent magnets. ***K. Tendeloo.*** *Henry Brutcher Translation No.* 4505, 11 pp. (From *Metalen*, v. 13, no. 15, 1958, p. 268-272.) Henry Brutcher, Altadena, California.

10721 Effect of Hydrogen on Structure and Properties of the Industrial Titanium Alloys VT 2, VT 3, and VT 3-1. Effects of H on mechanical properties of Ti alloys; working out the most favorable conditions for vacuum annealing of the Ti-2.5 Cr-1.7 Al alloy VT 2 to eliminate the harmful effects of H and improve the ductility. ***S. T. Glazunov, I. I. Kornilov, and A. M. Yakimova.*** *Henry Brutcher Translation No.* 4506, 11 pp. (From *Izvestiia Akademii Nauk, Otd. Tekhn. Nauk*, no. 9, Sept. 1958, p. 17-24.) Henry Brutcher, Altadena, Calif.

10722 Effect of Carbon on the Endurance Limit of Case-Carburized Steel. Effect of case and core C content. ***I. D. Rybasenko.*** *Henry Brutcher Translation No.* 4514, 5 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 10, Oct. 1957, p. 19-21.) Henry Brutcher, Altadena, Calif.

10723* Plastic Déformations During the Mechanical Retardation of Metal Shrinkage. The plastic deformations in absolute value are equal to the value of the free shrinkage in the interval of temperature. When the retardation of shrinkage increases in strength, the period of intensive deformation development becomes longer. Relatively small tensions when the process is applied to Silumin causes a significant decrease of the coefficient of linear shrinkage. (*In Russian.*) Plasticheskie deformatsii pri mekhanicheskom tormozhenii usadki metalla. ***Ia. A. Smolianitskii and N. I. Kaplii.*** *Izvestiia Vyssh'kh Uchebnykh Zavedenii, Chernaia Metallurgiia*, 1959, no. 2, Feb., p. 111-116.

10724* The Influence of Different Factors Upon the Strain Aging Embrittlement in Mild Steels. Deformation by tension, by compression and by drawing. Compression causes higher embrittlement than other types of deformation. A tentative explanation of the observed phenomena is discussed, involving "soft zones" in which critical stress for inducing plastic deformation is lower than in adjacent parts. (*In Swedish.*) Olika faktorers inverkan på förspródningen vid deformationsåldring av mjuka stål. ***Åke Josefsson.*** *Jernkontorets Annaler*, v. 143, no. 3, 1959, p. 121-150.

10725* Removing Strain Aging Embrittlement by Annealing at Temperatures Below the A_1-Point. Strain aging embrittlement is partly removed by annealing below A_1. Most complete recovery is obtained where the strain aging embrittlement has been greatest. Optimum temperature range is 600-650 C, holding time 2 hours. (*In Swedish.*) Avlägsnande av deformationsåldringsförspródning i mjuka stål genom glödgning vid temperaturer under A_1. ***Åke Josefsson.*** *Jernkontorets Annaler*, v. 143, no. 3, 1959, p. 151-166.

10726* Some Magnetic Properties of Dilute Ferromagnetic Alloys. In this study, work is extended to the production of precipitates in which departure from spherical shape is produced by cold drawing of suitable alloys. Magnetic measurements on the anisotropic specimens so produced are shown to give evidence for the distribution of particle shape, size and structure. The reverse magnetic field required to reduce the remanence to zero is shown to be an additional useful parameter in these determinations. Microphotographs of the samples showed that in all three cases the precipitates of the specimens of maximum coercivity were larger than would have been expected from single domain particles. Experiments are being continued. ***W. Sucksmith.*** *Journal de Physique et le Radium*, v. 20, nos. 2-3, Feb.-Mar. 1959, p. 290-294.

10727* Some Magnetic Properties of Platinum-Rich Pt-Fe Alloys. Measurements of magnetic susceptibility and spontaneous magnetization on face-centered cubic Pt-Fe alloys having compositions around Pt_3Fe and also on alloys with lower Fe contents are reported. In the Pt_3Fe superlattice region, the alloys appear to be antiferromagnetic when ordered and ferromagnetic when disordered. The more dilute alloys are ferromagnetic, even down to 2 at.% of Fe. ***J. Crangle.*** *Journal de Physique et le Radium*, v. 20, nos. 2-3, Feb.-Mar. 1959, p. 435 + 2 pages.

10728 Theory of Creep Limited by Self-Diffusion. A theory of steady-state creep at high temperature and stress is based on the climb of dislocations limited by the diffusion of vacancies from them. ***R. W. Christy.*** *Journal of Applied Physics*, v. 30, May 1959, p. 760-764.

10729* Methods for Determining the Thermodynamic Activities of Alloy Constituents at High Temperatures. Only a few methods are available for measuring the activities of alloy components at high temperature. Those most widely used consist in measuring equilibrium with a gas phase by transference experiments or with a liquid phase by distribution experiments, but there are many cases in which these are unsuitable or unduly cumbersome. In order to determine activities in alloys at high temperatures in such cases, two methods for measuring vapor or reaction pressures have been used. ***P. Gross, D. L. Levi, and G. L. Wilson.*** *Journal of the Less-Common Metals*, v. 1, no. 2, Apr. 1959, p. 113-115.

10730* Techniques for Creep Testing at High Temperatures. Purpose of the present contribution is to describe some of the experiments which have been carried out at the National Physical Laboratory to develop techniques for creep testing metals and cermets at high temperatures. The development of these techniques is not complete but it is hoped that the results described will be of interest to those who propose to enter this field of testing. ***D. J. Armstrong, D. Murray, and L. M. T. Hopkin.*** *Journal of the Less-Common Metals*, v. 1, no. 2, Apr. 1959, p. 125-131.

10731* Preliminary Observations on Methods of Measuring Mechanical Properties of Solids at High Temperatures. Tensile strength of refractory metals of temperature up to 2500 C; measurement of the coefficient of friction of metallic carbides and its variation with temperature. ***Barry L. Mordike and Leo M. Fitzgerald.*** *Journal of the Less-Common Metals*, v. 1, no. 2, Apr. 1959, p. 132-138.

10732* Theory of Thermal Stresses. Discusses an extension of the theory of thermal stresses which removes certain limitations of the simple theory. This extension was made in the first place to deal with problems involving graphite at high temperatures, but hopes are that the method will find application in the theory of the thermal fatigue of metals. ***D. M. Gilbey.*** *Journal of the Less-Common Metals*, v. 1, no. 2, Apr. 1959, p. 139-144.

10733* Atmospheric Contamination of Chromium and Its Effect on Mechanical Properties. Chromium heated in air at 950 C for 200 hours is contaminated to a considerable extent by N. This has a marked effect on the mechanical properties, especially the ductile → brittle transition temperature, the magnitude of the effect depending on the rate of cooling from 950 C. ***G. R. Wilms and T. W. Rea.*** *Journal of the Less-Common Metals*, v. 1, no. 2, Apr. 1959, p. 152-156.

10734 Evaluating High-Temperature Materials. Such tests as creep, stress rupture, fatigue, and notch tensile, formerly limited to materials for critically stressed applications, have become today's standards. There are many details and refinements of these property tests that are commonly overlooked.

Gives some suggestions that should help get the most out of test data and aid in selecting an alloy suitable for loads and stresses encountered in service. ***Edward A. Loria.*** *Machine Design*, v. 31, May 28, 1959, p. 121-125.

10735 Note on the Prediction of Relaxation Stress-Time Curves From Static Tensile Test Data. Static tensile and creep relaxation tests were made on an Mg alloy at 20 C., and the results analysed to examine possibility of prediction of relaxation stress-time curves on basis of static tensile test data, and on assumption of existence of a mechanical equation of state. Results of these tests provide no evidence of the existence of such an equation of state for this material, and indicate that a reasonably close prediction of relaxation stress-time curves from static tensile test data is not possible. ***A. E. Johnson, J. Henderson, and V. D. Mathur.*** *Metallurgia*, v. 59, May 1959, p. 215-220.

10736 The Low-Temperature Mechanical Properties of Some Cast Stainless Steels. The tensile and impact properties of several cast austenitic stainless steels, at temperatures between 100 and −196 C are presented. ***G. Mayer and K. Balajiva.*** *Metallurgia*, v. 59, May 1959, p. 221-226.

10737 Ductile Cleavage Fracture of Molybdenum. Describes work being done in the study of these fractures. ***A. A. Johnson and B. J. Shaw.*** *Nature*, v. 183, May 30, 1959, p. 1542-1543.

10738 Spectral Emissivity of Tungsten. An experiment designed to measure the spectral emissivity of W, in which a direct comparison method is utilized so that the spectral emissivity is observed directly as the ratio of light intensity from a W source to that from a blackbody source, is described. The spectral emissivity was measured over the wavelength interval 310 to 800 mμ, and the temperature interval 1600 to 2400 K. ***Robert D. Larrabee.*** *Optical Society of America, Journal*, v. 49, June 1959, p. 619-625.

10739 Physical Properties of Metals. v. I. The Electronic Theory of Metals—Thermoelastic Behavior—Magnetism. Progress in the field of atomic physics and considerations related to the electron theory have rendered a revision of Professor Borelius' electron theory of metals necessary. This theory is emphasized in this volume—the first of a series to appear and constitute a Handbook of Metal Physics—and has served as a guiding principle in studying the properties of metal exhibiting no transfer phenomena in the electron gas. An effort has been made to treat the question of dia- and paramagnetism as thoroughly as possible, thus permitting a deep insight in the electron structure of the individual metals. (*In German.*) Physikalische Eigenschaften der Metalle. v. I. Metallelektronentheorie—Thermisch-Elastisches Verhalten—Magnetismus. ***Eckhart Vogt.*** 467 pp. 1958. Akademische Verlagsgesellschaft Geest & Portig K.-G., Leipzig, Germany. (TN690 V86p)

10740 High-Energy Photoprotons From Silver. The energy distributions and absolute yields of photoprotons of energy greater than 10 Mev from Ag were measured for maximum bremstrahlung energies between 16 and 32 MeV. ***K. H. Lokan.*** *Physical Society, Proceedings*, v. 73, pt. 5, May 1959, p. 697-704.

10741 On the Electrical Conductivity of Metals. The exact formula for the electrical conductivity of a metal, derived by Kubo, Greenwood, and others, is evaluated using Van Hove's methods for quantum mechanical transport problems. The evaluation is restricted to the case of elastic scattering by impurities or lattice vibrations, but completely avoids the use of the customary random phase assumption. ***G. V. Chester and A. Thellung.*** *Physical Society, Proceedings*, v. 73, pt. 5, May 1959, p. 745-766.

10742 The Effect of Copper on the Work Function of Liquid Tin. ***T. C. Toye.*** *Physical Society, Proceedings*, v. 73, pt. 5, May 1959, p. 807-810.

10743 The Resistance to Brittle Fracture in Structural Steel. A Survey of Experiments, Investigations and Problems With the Contribution of the Experiments of the German Steel Construction Committee (DASt). A study of the problem of resistance to brittle fracture in structural steel elements in overhead structures, bridges, crafts, pressure pipes, etc., with emphasis on the necessary collaboration between metallurgists, designers and analysts. The study is limited to low deformation fractures occurring after construction. (*In German.*) Die Sprödbruchsicherheit von Stahlkonstruktionen. Eine Übersicht über Erfahrungen, Versuche und Probleme mit Heranziehung des Versuche des Deutschen Ausschusses für Stahlbau (DASt). ***Karl Rühl.*** 151 pp., 1959. Werner-Verlag, Düsseldorf, Germany. (TA472 R83s).

10744* Behavior of Pure Iron Under Impact Tensile Loading. The behavior of pure Fe under impact tensile loading was studied with two kinds of pure irons and a commercial low C steel. One half of specimens were annealed in vacuum at 600, 700, 800, 850, 920, and 1000 C for 1 hour and the others were quenched in oil after keeping them at these temperatures for 1 hour in vacuum. (*In Japanese and English.*) ***Seita Sakui and Masanobu Omori.*** *Tetsu to Hagane (Journal of the Iron and Steel Institute of Japan)*, v. 45, no. 4, Apr. 1959, p. 415-423.

10745* Studies on Nickel-Base Heat-Resisting Alloys. VI. Effect of Ti and Al etc., on Mechanical Properties of Nimonic 80A. (*In Japanese and English.*) ***Taro Hasegawa.*** *Tetsu to Hagane (Journal of the Iron and Steel Institute of Japan)*, v. 45, no. 4, Apr. 1959, p. 432-437.

10746* Elevated Temperature Relaxation Properties of 17-7 PH Stainless Helical Compression Springs. For comparative purposes, 18 Cr-8 Ni, Inconel "X" and music wire springs were included. ***Mason Clogg, Jr.*** *Wire*, no. 40, Apr. 1959, p. 31-35.

10747* A Method for Determining the Magnetic Properties of Electrical Steel in Low and Average Magnetic Fields. A study of the effects of the demagnetization of the specimens after thermal treatment, of the condition to determine the magnetic texture of a specimen and of the time-decrease of permeability on the results obtained in measuring the magnetic properties of steels between 0.002 −25 a/cm. (*In Russian.*) O metodike izmereniia magnitnykh svoĭstv elektrotekhnicheskoĭ stali v slabykh i srednikh poliakh. ***O. N. Al'tgauzen and N. A. Semenova.*** *Zavodskaia Laboratoriia*, v. 25, no. 4, 1959, p. 426-428.

See also: **10441** (materials and processes of electron devices); **10799** (properties of Ti alloys); **10837** (hardness of brass).

METALS—MECHANICAL WORKING

10748 The Effect of a Lead Additive on the Machinability of Alloy Steels. The use of a Pb additive in medium-carbon alloy steels will result in appreciable increases in tool life for those steels having a hardness of R_c30 or less. The advantage of the additive will decrease as the hardness of the steel increases beyond R_c30. At some point in the hardness range of R_c35 to R_c40 or higher, the presence of the additive may be detrimental to tool life. Appreciable improvement in surface finish is obtainable on medium-carbon alloy steels, regardless of the hardness of the steel. The addition of Pb to medium-carbon steels at various hardness levels will result in a reduction of 15 to 25% in power required in machining. ***Norman Zlatin and John V. Gould.*** *ASME, Transactions, Series B, Journal of Engineering for Industry*, v. 81, no. 2, May 1959, p. 131-138.

10749 Controlled Contact Cutting Tools. A substantial reduction in power consumption, an increase in tool life, more effective utilization of cutting fluids, and improved surface finish on the machined workpiece were achieved by suitably controlling the length of tool-chip contact. ***B. T. Chao and K. J. Trigger.*** *ASME, Transactions, Series B, Journal of Engineering for Industry*, v. 81, no. 2, May 1959, p. 139-151.

10750 A Study of the Effects of Tool Flank Wear on Tool Chip Interface Temperature. A study of the effect of land wear upon the interface temperature between a carbide tool and an AISI 1015 steel workpiece is presented. The wear lands were ground on the tools to eliminate the effects of cratering and to produce uniform wear lands. The tool-work

thermocouple technique was used to measure the interface temperature. The results at all feeds and speeds indicate that a wear land of 0.010 in. produces a lower interface temperature than a sharp tool. ***D. R. Olberts.*** *ASME, Transactions, Series B, Journal of Engineering for Industry,* v. 81, no. 2, May 1959, p. 152-158.

10751 Self-Excited Vibrations in Metal Cutting. The basic mechanisms which cause self-excited vibrations of a cutting tool relative to the work are discussed in a qualitative manner. Similarly, mechanisms inherent in the cutting process which can damp or limit vibrations are discussed. Experiments are presented which are in agreement with the theory. ***Nathan H. Cook.*** *ASME, Transactions, Series B, Journal of Engineering for Industry,* v. 81, no. 2, May 1959, p. 183-186.

10752 A Thermocouple-Technique Investigation of Temperature Distribution in the Workpiece During Metal Cutting. *M. B. Hollander and J. E. Englund.* *ASTE Research Report No.* 7, July 31, 1957, 18 pp. (TJ1186 Am35r Contin.)

10753 An Infrared-Microradiation-Pyrometer-Technique Investigation of the Temperature Distribution in the Workpiece During Metal Cutting. *Milton B. Hollander.* *ASTE Research Report No.* 21, Feb. 1, 1959, 39 pp. (TJ1186 Am35r Contin.)

10754* Case of the J-85 Compressor. Budd's metalworking skill produces intricate cross-section of Ge-designed, high thrust-to-weight jet. ***S. Peter Karpielyan.*** *Aircraft and Missiles Manufacturing,* v. 2, May 1959, p. 10-15.

10755 Explosive Forming—How it Works, What it Does. High-energy-rate forming shows advantages in economy where workpieces are extra large, complicated in shape, and made of especially tough materials. The state of the art is still largely experimental, but many prototype parts in all sizes have been made, and some few parts are now in production. *American Machinist,* v. 103, June 15, 1959, p. 127-130.

10756 Explosive Forming—the Planemaker's Newest, Hottest Tool. Three years of study have indicated that better parts can be made with high-energy-rate forming, and at lower cost than with conventional equipment. ***George H. DeGroat.*** *American Machinist,* v. 103, June 15, 1959, p. 131-134.

10757 Explosives Form Tubes With and Without Dies. Pressure vs. distance from charge to work produces straight-line curves on log-log graph paper. This allows scaling up for larger work. ***Jacob Savitt.*** *American Machinist,* v. 103, June 15, 1959, p. 135-137.

10758 New Die Steels for the Drop Forging of Creep-Resisting Steels and Alloys. Report on fifteen new drop-forging die steels; their performance compared with a conventional die steel containing 0.35% C, 0.40 Mn, 0.30 Si, 2.75 Cr, 0.5 V, 7.0 W. ***A. P. Gulyaev, S. L. Rustem, G. N. Orekhov, and G. P. Alekseeva.*** *Henry Brutcher Translation No.* 4274, 14 pp. (From *Metallovedenie i Obrabotka Metallov,* no. 7, July 1958, p. 2-10.) Henry Brutcher, Altadena, Calif.

10759 Structure and Properties of Alloys (and Steels) After Vibrational Working. Lack of data on changes in structure and properties of metals and alloys brought about by vibrational working. Study of two Al alloys and a 0.40% C, 0.90 Cr, 1.50 Ni steel, worked on a vibro-press—on which details are given—, a hydropress, and a drop-forging unit, for macrostructure, microstructure, hardness and grain size distribution, amounts of actual reduction in upsetting, and structure in zones of friction and slip. Advantages of vibrational upsetting; reasons for its superiority over other methods of upsetting. ***S. N. Shestakov and M. Ya. Karnov.*** *Henry Brutcher Translation No.* 4281, 7 pp. (From *Metallovedenie i Obrabotka Metallov,* no. 7, July 1958, p. 35-38.) Henry Brutcher, Altadena, Calif.

10760 Effect of Final Forging Temperature on Mechanical Properties of [Turbine Disk] Forgings. Development of an improved heat treating practice for one-ton turbine-disk or compressor-disk blanks. Sampling technique for determination of mechanical properties as function of heat treatment. Microstructure of forgings. Results of industrial-scale trials on disk forgings: dimensions of forgings; final forging temperatures in relation to mechanical properties. ***I. G. Generson.*** *Henry Brutcher Translation No.* 4322, 10 pp. (From *Metallovedenie i Obrabotka Metallov,* no. 8, Aug. 1958, p. 46-51.) Henry Brutcher, Altadena, Calif.

10761 New Method of Determining Forgeability of Metals. Description of equipment simulating actual conditions in press forging, for assessing forgeability. Formulas for calculating the minimum critical reduction and forgeability. Usefulness of proposed method in improving plasticity of metal for subsequent forging and for industrial-scale production. ***D. I. Berezhkovskii.*** *Henry Brutcher Translation No.* 4439, 6 pp. (From *Zavodskaya Laboratoriya,* v. 24, no. 7, 1958, p. 858-860.) Henry Brutcher, Altadena, Calif.

10762 Electrochemico-Mechanical Machining of Hard Metals. Effects of operational variables on metal removal and surface finish. Recommends optimum currents, feed, and pressure settings. ***B. S. Korshunov.*** *Henry Brutcher Translation No.* 4441, 5 pp. (From *Vestnik Mashinostroeniya,* v. 37, no. 9, 1957, p. 54-56.) Henry Brutcher, Altadena, Calif.

10763 Influence of Residual Stresses in Hardened Tool Steels on Incidence of Grinding Cracks. Influence of transformation temperature on distribution of residual stresses in cylinder-shaped specimens of various low C, high-Ni steels. ***H. Bühler and W. Schepp.*** *Henry Brutcher Translation No.* 4471, 12 pp. (From *Stahl und Eisen,* v. 77, no. 23, 1957, p. 1686-1690.) Henry Brutcher, Altadena, Calif.

10764 Apparatus for Drawing of Metals and Rolling Them With Free-Running Rollers in a Liquid Under High Hydrostatic Pressure. Bridgman's work on drawing steel into wire under high hydrostatic pressures. Work done in the Soviet Union on the extrusion of metals by high-pressure liquids. Design of preliminary laboratory device for drawing metals into wire and rolling metals with free-running rollers, both under high-pressure liquids. Principle of apparatus; its operation; steel compositions used for its most highly stressed parts. ***B. I. Beresnev, L. F. Vereshchagin, and Yu. N. Ryabinin.*** *Henry Brutcher Translation No.* 4488, 7 pp. (From *Tsvetnye Metally,* v. 31, no. 8, 1958, p. 61-63.) Henry Brutcher, Altadena, Calif.

10765 Martensite Wire. Development and commercial production of fully martensitic steel wire from low-carbon steel wire with 0.05 to 0.25% C. Advantages of martensite wire are high toughness, good tensile properties (equal to those of high-carbon wire), corrosion and acid resistance, weldability and drawability, and absence of embrittlement caused by local martensite formation. Martensite wire is eminently suitable as spring and rope wire. ***T. Nishioka.*** *Henry Brutcher Translation No.* 4510, 13 pp. (From *Tetsu to Hagane,* v. 44, no. 2, 1958, p. 151-157.) Henry Brutcher, Altadena, Calif.

10766 Plasticization of Surface Layer of Metals Being Worked, by Adsorption From Surface-Active Lubricants. Increase in shear resistance with increase in the amount of reduction, for nonactive lubricants, and decrease in shear resistance of plasticized thin surface layer (to which plastic flow is confined), for surface-active lubricants. Effect of coating thickness. Role of oxide films in adsorptional plasticization. Factors determining the effectiveness of lubricating liquids in metal working, particularly at high pressures. ***S. Ia. Veiler, V. I. Likhtman, and P. A. Rebinder.*** *Henry Brutcher Translation No.* 4557, 8 pp. (From *Doklady Akademii Nauk SSSR,* v. 116, no. 3, 1957, p. 415-418.) Henry Brutcher, Altadena, Calif.

10767 Dimensional Control in Precision Manufacturing. Process planning; tolerance charts; cost estimating; tool troubles and problems. ***John L. Gadzala.*** 203 pp. 1959. McGraw-Hill, New York. (TJ1125 G11d)

10768 An Analysis of the Mechanics of Cold Strip Rolling. Power requirements of a given rolling mill for reducing strip can be predicted by application of the theory presented. This theory takes into account the elastic deformation of the strip and rolls and effect of applied tensions as well as plastic strip deformation. It has applications in investigation of causes of non-uniform strip gage and roll fatigue failure. ***Donald Jortner, J. Fletcher Osterle, and Carl F. Zorowski.*** *Iron & Steel Engineer,* v. 36, no. 5, May 1959, p. 127-135.

10769 Report on Explosive Forming. Conflicting opinions were frequently voiced by some 20 forming experts who served as panelists during more than two full days of special technical sessions at the Eleventh Western Metal Congress and Exposition, Los Angeles, in March. But they all agreed that high-energy forming is here to stay. ***Thomas A. Dickinson.*** *Light Metals*, v. 22, May 1959, p. 136-137.

10770 Metal Expanding. Basic elements of a metal expanding machine are a cone (actually a poly-sided modified frustrum of a pyramid), drawbar, jaws, table, and power system. The expanding machine uses the principle of the inclined plane or wedge. Mounted in a radially slotted table, the jaws are forced uniformly outward by the cone actuated by the drawbar. ***J. F. Coleman.*** *Machine Design*, v. 31, May 28, 1959, p. 110-112.

10771 Unusual Fracturing of Hard-Drawn High-Conductivity Copper Strand. Description is presented of fracturing of stranded Cu conductor in the interval between lagging the drums at completion of stranding and opening them for use. The phenomenon was associated with change in type of wood used for drums and results of an investigation into cause of failure are given. ***Clement Blazey.*** *Metallurgia*, v. 59, May 1959, p. 237-240.

10772 Forgeability of Steels. A Critical Survey of the Literature. Effect of alloying elements on the hot-workability aspect of the fabrication of steels. Prediction of changes in forgeability characteristics. Different types of tests used and limitations. ***G. P. Contractor and W. A. Morgan.*** *Metal Treatment and Drop Forging*, v. 26, Feb. 1959, p. 65-71.

10773 Forgeability of Steels. A Critical Survey of the Literature. II. ***G. P. Contractor and W. A. Morgan.*** *Metal Treatment and Drop Forging*, v. 26, Mar. 1959, p. 107-114.

10774* Some Properties of Spark-Eroded Surfaces. The basic assumption is that the stream of electrons is braked in the anode and its energy is converted into heat. The same applies to the stream of ions emerging from the anode and hitting the cathode (tool electrode) and this explains the erosion of the tool electrode. Since there is some delay between the impact of electrons and the arrival on the cathode of ions generated by that impact, tool erosion should be expected to depend on the duration of the discharge. ***M. Barash.*** *Microtecnic* (English Edition), v. 13, no. 1, Feb. 1959, p. 1-4.

10775* On the Wear of Grinding Wheels. Analysis of relationships between wheel speed, grinding time, metal removal, feed, surface quality of workpiece, and other factors. ***J. Koloc.*** *Microtecnic* (English Edition), v. 13, no. 1, Feb. 1959, p. 12-15.

10776* Measurement of Gripping Capacity of Hand-Operated Three-Jaw Chucks. Measuring the gripping capacity; correlation between spanner moment and gripping force; influence of centrifugal force on the gripping capacity; rotary speed limits of the chucks with respect to the reduction in the chucking force. ***G. Pahlitzsch.*** *Microtecnic* (English Edition), v. 13, no. 1, Feb. 1959, p. 16-19.

10777* Effects of the Conditions of Extrusion and Recrystallization Retarding Additions on the Effect of Extrusion of Forging Aluminum Alloys. Double extrusion was applied to the production of small thin-walled profiles and the influence on the extrusion effect of AlCuMg and AlZnMgCu was studied, especially as a function of deformation and temperature. (*In German.*) Über den Einfluss der Pressbedingungen und rekristallisations-hemmender Zusätze auf den Presseffekt von Aluminium-Knetlegierungen. ***Bruno Beyer and Hellmuth Seliger.*** *Neue Hütte*, v. 4, Mar. 1959, p. 165-173.

10778 Fabrication of Iron-Aluminum Chromium Alloy Fuel Plates. Characteristics (oxidation resistance, moderate cross section, and adaptability to reprocessing) that recommend Fe-Al alloys for use as cladding materials for gas-cooled core components, and the metallurgical peculiarities (brittleness, joining difficulties, and marginal hot strength) that have limited their use in the past. Properties of a newly-developed Fe-Al base alloy (7½ wt. % Al, 5 wt. % Cr, 1 wt. % Cb, ¾ wt. % Ti, remainder Fe) in which the deficiencies of older materials have been largely eliminated. ***Blake King, J. Neri, and F. G. Tate.*** Paper from "Nuclear Metallurgy. v. V. Ceramic Base Elements; Metal Base Fuels and Jacket Components", American Institute of Mining, Metallurgical, and Petroleum Engineers, New York. 1958, p. 63-68. (TN697 Am35n5)

10779 Fabrication of Zircaloy-2 Clad Uranium-12 Wt Pct Molybdenum Fuel Rods. During the initial development of fuel elements for the PWR, the use of clad metallic-fuel rods was investigated. Design criteria were that the fuel and cladding must be metallurgically bonded for proper heat transfer, and the fuel, cladding, and diffusion zone between the fuel and cladding must be corrosion resistant. ***J. G. Goodwin, R. W. Tombaugh, E. L. Richards, and F. R. Lorenz.*** Paper from "Nuclear Metallurgy. v. V. Ceramic Base Elements; Metal Base Fuels and Jacket Components", American Institute of Mining, Metallurgical, and Petroleum Engineers, New York. 1958, p. 69-75. (TN697 Am35n5)

10780* Air Force Program Evaluates the Machining Characteristics of AISI 4340 Low Alloy Steel. ***P. R. Arzt, J. V. Gould, and J. Maranchik, Jr.*** *SAE Journal*, v. 67, May 1959, p. 37-45.

10781* Experience in and Knowledge Gained From the Operation of a Hot Strip Rolling Mill Train and a Cold Strip Rolling Mill. Description and characteristic data. Relation between rolling schedule and power consumption as well as between power required and motor capacity at the single operation spots. Conclusions drawn from practical experience for the design of a wide strip mill train and for determining the dimensions of constructional elements. Economic efficiency of the tandem mill train as dependent on the rolling schedule. (*In German.*) Betriebserfahrungen und Erkenntnisse an einer Warmbreitband-Strasse und einem Kaltbandwerk. ***Erwin A. Spenlé.*** *Stahl und Eisen*, v. 79, no. 10, May 14, 1959, p. 683-693.

10782* Throwaway Cutters Save $15,596 a Year. A highly organized program at Westinghouse integrates carbide inserts into the plant in three months. ***C. Brown and J. F. Einloth.*** *Steel*, v. 144, May 11, 1959, p. 164-165.

10783* Fine Turning of Small Holes by Means of Sintered Carbides. Minimal feed turning; cutting resistances when cutting fine chips; utilization of sintered carbides as holder material. (*In Czech.*) Jemné soustružení malých děr slinutými karbidy. ***Ant. Vendr and Vl. Nejedlo.*** *Strojírenská Výroba*, v. 7, no. 4, Apr. 1959, p. 147-151.

10784* Shearing Tools of Sintered Carbides. Description; resulting economies. (*In Czech.*) Střižné nástroje se slinutými karbidy. ***Jan Olejník.*** *Strojírenská Výroba*, v. 7, no. 4, Apr. 1959, p. 152-158.

10785* Copy Turning by Means of Ceramic Tools. A summary of experiences with ceramic turning tools used on semi-automatic copying lathes. (*In Czech.*) Kopírovací soustružení keramickými nástroji. ***H. Renker.*** *Strojírenská Výroba*, v. 7, no. 4, Apr. 1959, p. 159-161.

10786* Cold Working. I. Shearing. Review. (*In Japanese.*) ***Yasuo Kasuga.*** *Tetsu to Hagane (Journal of the Iron and Steel Institute of Japan)*, v. 45, no. 4, Apr. 1959, p. 451-462.

10787 Remote Fabrication of SRE Fuel Rods in the Processing Refabrication Experiment. Test, evaluation, and modification of basic operating mechanisms with emphasis on the development of remotely-maintainable mechanisms and techniques to achieve consistently good cap-to-can seals and simple, reliable mechanical components. In the PRE experimental program, short dummy fuel rods were consistently made with leak-tight and structurally sound welds. ***T. A. Golding, D. Janeves, M. A. Fallandy, F. E. Vonderahe, and K. L. Mattern.*** *U. S. Atomic Energy Commission, NAA-SR-2989*, May 1, 1959, 36 pp. (UF767 Un3.1na Contin.)

10788 Some Electrical Phenomena in Metal Cutting. Dependence of thermo-e.m.f. on cutting conditions; effects of naturally generated and additional injected current. ***V. Solaja and H. L. Hughes.*** *Wear*, v. 2, no. 4, May 1959, p. 311-314.

10789* Reeling and Coil Conveying Equipment in Wire Rod and Merchant Mills. Design and method of operation of equipment for coils of wire rod and merchant bars. ***Albert Hinders.*** *Wire*, no. 39, Feb. 1959, p. 3-12.

10790* From Wire to Bolt Design. Working Life and Efficiency of the Forming Tools. Various forming methods such as wire drawing, cold heading, reducing, extruding, etc., are used in the manufacture of screws, rivets, and shaped bolts. In all these methods, there is a close relationship between the shape of the tool and the deformation process on one hand, and the deformation method, stress, design, and working life of the tools on the other hand. ***Karl Sieber.*** *Wire*, no. 39, Feb. 1959, p. 14-21.

10791* Fine-Wire Coil Winding Machines at the 1958 German Industries Fair. *Wire*, no. 40, Apr. 1959, p. 37-41.

10792* The Use of Containers for Enamelled Copper Wire. *P. Aumann.* *Wire*, no. 40, Apr. 1959, p. 48-51.

See also: **9885** (airforce research on fabrication of metals); **10618** (roll neck-bearings); **10837** (rolling of brass); **10839** (cemented-boride tool bits).

METALS—METALLOGRAPHY, TRANSFORMATIONS, AND STRUCTURES

10793 Tempering Characteristics After Induction Hardening. Study of changes in structure and mechanical properties of several low-alloy structural steels and C tool steels during conventional tempering as function of conditions of preceding induction hardening, with emphasis on specific structures obtained. ***I. N. Kidin, E. V. Astaf'eva, and A. N. Marshalkin.*** *Henry Brutcher Translation No.* 4348, 21 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 9, Sept. 1958, p. 2-12.) Henry Brutcher, Altadena, Calif.

10794 Effect of Nitrogen on Austenite Grain Growth in Medium-Carbon Steél With Increased Phosphorus Content. Interpretation of results, based on microexamination of ferrite in steels at maximum magnifications. ***V. N. Svechnikov and I. Kh. Trush.*** *Henry Brutcher Translation No.* 4350, 10 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 9, Sept. 1958, p. 15-19.) Henry Brutcher, Altadena, Calif.

10795 Phases Present in Chromium-Nickel Austenitic Steels Containing Titanium. Correlations regarding the formation of Ti-containing phases in austenitic steels. Variation of amount of electrolytic residue with aging temperature and corresponding variation of Ti percentage. Changes in content of the various components in the phases and in weight of the electrolytic residue and lattice parameter with aging temperature. ***V. I. Prosvirin.*** *Henry Brutcher Translation No.* 4387, 5 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 10, Oct. 1958, p. 2-5.) Henry Brutcher, Altadena, Calif.

10796 TTT Diagram for Spheroidal-Graphite Cast Iron. Characteristics of transformations are shown on diagrams: graphitization of pearlite; transformations in eutectoid range; austenite formation. Examples of practical use of these diagrams for selecting the best temperatures or holding times for various forms of heat treating such as annealing to produce ferrite or a specified ratio of ferrite to pearlite. ***D. Rasheev.*** *Henry Brutcher Translation No.* 4388, 9 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 10, Oct. 1958, p. 5-10.) Henry Brutcher, Altadena, Calif.

10797 Effect of Cold Rolling and Heat Treating Conditions on Structure of Steel EI428. Study of changes in structure of a 0.1% C, 0.25 Mn, 1.60 Si, 6.0 Cr, 0.85 Al, 0.015 P, 0.006 S steel under various cold-working and heat-treating conditions to minimize its susceptibility to develop cracks in further processing (for example, into tubes). ***E. Yu. Chemadurova.*** *Henry Brutcher Translation No.* 4394, 8 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 10, Oct. 1958, p. 36-40.) Henry Brutcher, Altadena, Calif.

10798 Effect of Manganese on Activity and Solubility of Oxygen in Liquid Iron. Determination of equilibrium O concentrations in liquid Fe-Mn alloys, required for calculating effect of Mn on activity of O and experimental check of literature data on influence of Mn on solubility of O in liquid Fe. ***V. V. Averin, R. A. Karasev, A. Yu. Polyakov, and A. M. Samarin.*** *Henry Brutcher Translation No.* 4456, 11 pp. (From *Izvestiya Akad. Nauk SSSR, Otd. Tekhn. Nauk*, no. 11, Nov. 1956, p. 52-57.) Henry Brutcher, Altadena, Calif.

10799 Effect of Hydrogen on Structure and Properties of Titanium and Its Alloys. *S. G. Glazunov, I. I. Kornilov, and A. M. Yakimova.* *Henry Brutcher Translation No.* 4494, 14 pp. (From *Izvestiya Akademii Nauk SSSR, Otd. Tekh. Nauk*, no. 6, June 1958, p. 30-36.) Henry Brutcher, Altadena, Calif.

10800 Comparison of Methods for Determination of Oxide Inclusions in Steel. Comparative study of the two most reliable methods for anodic isolation of oxide inclusions from steel samples. ***V. A. Mchedlishvili.*** *Henry Brutcher Translation No.* 4496, 14 pp. (From *Zavodskaya Laboratoriya*, v. 24, no. 10, 1958, p. 1171-1178.) Henry Brutcher, Altadena, Calif.

10801 Dendritic Segregation of Silicon in Steel. Effect of cooling rate of solidifying steel on extent of silicon segregation and on range of austenitizing in eutectoid silicon steels. ***Ya. N. Malinochka.*** *Henry Brutcher Translation No.* 4503, 7 pp. (From *Stal'*, v. 18, no. 12, 1958, p. 1130-1132.) Henry Brutcher, Altadena, Calif.

10802 Effect of Ultrasonic Vibrations on the Precipitation Hardening and Tempering of Some Alloys. Results obtained with use of ultrasonic vibrations in speeding up of natural and artificial aging of an Al-Mg-Zn-Cu alloy. Effect of ultrasound on the tempering of as-quenched carbon tool steel. Nature of acceleration of age hardening by ultrasound of various intensities and frequencies. ***K. M. Pogodina-Alekseeva and G. I. Eskin.*** *Henry Brutcher Translation No.* 4551, 7 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 1, Jan. 1956, p. 42-45.) Henry Brutcher, Altadena, Calif.

10803* Study of Phase Propagation in Superconducting Aluminum by Ultrasonic Attenuation Measurements. The time taken for the destruction of the superconducting phase in a cylindrical specimen, by means of a magnetic field, H, greater than the critical field, H_c, is approximately proportional to $H/(H-H_c)$ in agreement with eddy-current theory. In the converse case, where the superconducting phase is restored by switching off the magnetic field H ($>H_c$), the total time taken is nearly independent of the temperature (or H_c) as well as H. The superconducting phase grows at a non-uniform volume rate which is considerably less than the uniform rate of collapse. ***K. L. Chopra and T. S. Hutchison.*** *Canadian Journal of Physics*, v. 37, May 1959, p. 614-618.

10804* High Temperature X-Ray Chamber. Description of a high temperature X-ray chamber for investigations of the changes of phases and of the microstructure at higher temperatures. Specimen is heated in two small coaxial cylindrical resistance furnaces with a diffraction slot between them. The whole system is enclosed in a cylindrical casket of the diameter of 57.3 or 64 mm and is placed under a removable recipient where there is a vacuum of the order of 10^{-3} until 10^{-5} Hg can be reached to prevent the oxidation of specimens. (*In Czech.*) Vysokoteplotní rentgenová komůrka. ***Zdeněk Jiskra and Bernard Fleischer.*** *Hutnické Listy*, v. 14, no. 4, Apr. 1959, p. 280-286.

10805* Carbon Carrier Foils and Replicas for Electron Microscopy and Diffractography. Carbon foils and replicas have a number of suitable properties for the use in electron microscopy and diffractography. It is possible to await their propagation as strengthening foils and with growing demands upon high resolving power of replicas, also their wide use as replicas. (*In Czech.*) Uhlíkové nosné folie a otisky pro elektronovou mikroskopii a difraktografii. ***Miroslav Rozsíval.*** *Hutnické Listy*, v. 14, no. 4, Apr. 1959, p. 307-309.

10806* An X-Ray Study of Cold Worked Kovar Alloys. The systematic investigation of these cold-worked alloys enabled the authors not only to penetrate into the mechanism of lattice distortion but made it possible to find a simple criterion for the evaluation of stability of Kovar alloys. From experi-

mental work, the following conclusions were made: (1) the diminutions of the distortion factor of the α-phase can be explained by the fact that only one part of the total deformation energy is consumed to the formation of lattice distortions and the other one for the formation of a new α-phase; (2) the variations of both the factors Bα and Bγ can be also interpreted according to Wood by the principle of the existence of an upper and lower limit of crystal size; (3) the content of the α-phase rises with higher degree of deformation; (4) a Kovar alloy is the more stable the smaller the increment of the α-phase content at a given degree of cold working. (*In Czech.*) Rentgenografická studie plasticky tvářených kovarových slitin. ***Alexander Spirkov.*** *Hutnické Listy*, v. 14, no. 4, Apr. 1959, p. 316-322.

10807* Effects of the Components on the Hydrogen Penetrability in Steel and Binary Iron-Based Alloys. Most of the alloying additions studied (C, Si, Cr, Mn and possibly Al) cause a considerable decrease of the rate of diffusion of H in steel. There is a change in the reactions between the particles of the ferrite lattice, with local disturbances of the energetic electron spectrum as well as a dislocation of the crystal lattice, a variation of the interatomic distances and of the parameters of the junctions. (*In Russian.*) Vliianie legiruiushchikh elementov na vodorodopronitsaemost' staleI i binarnykh splavov na osnove zheleza. ***R. A. Riabov and P. V. Gel'd.*** *Izvestiia Vysshikh Uchebnykh Zavedenĭ, Chernaia Metallurgiia*, 1959, no. 2, Feb., p. 83-92.

10808* The Transition in Chromium and in Some Alloys of Chromium With Small Amounts of Other Transition Elements. The transition in Cr at 38 C is investigated by measuring the influence on the electrical resistance and the Hall effect of alloying with about 1 at.% of V, Mn, Fe, Co, or Ni. The results prove the electronic nature of the transition and give an indication of the identity of the 38 C transition with the Néel point. ***G. De Vries.*** *Journal de Physique et le Radium*, v. 20, nos. 2-3, Feb.-Mar. 1959, p. 438-439.

10809 Structure of Quenched and Irradiated Metals. The effect of introducing point defects into pure metals by (a) quenching and (b) irradiation has been studied using the small-angle X-ray scatter technique. Scattering was obtained from both quenched Cu and Al after appropriate aging treatments, from α-irradiated Cu after annealing, and from neutron-irradiated Cu. The source of scattering has been considered in each case. ***R. E. Smallman and K. H. Westmacott.*** *Journal of Applied Physics*, v. 30, May 1959, p. 603-616.

10810 Small Angle Scattering of X-Rays by Plastically Deformed Single Crystals. The small angle scattering of X-rays from single crystals of magnesium plastically deformed in simple shear has been measured in the angular range of 4′ to 5°. The crystals were subjected to both undirectional and cyclic shear stresses applied along the [1120] direction. No evidence for small angle scattering by dislocations was found. ***W. H. Robinson and R. Smoluchowski.*** *Journal of Applied Physics*, v. 30, May 1959, p. 617-621.

10811 Internal Double Reflection in a Perfect Crystal. The theory of double Bragg reflections in single crystals is derived on both a kinematical and dynamical basis. Experiments are reported using single crystals of LiF, diamond, Al-Cu, pentaerithritol, and stilbene, and comparisons made with the theory. ***A. Guinier and E. Guyon.*** *Journal of Applied Physics*, v. 30, May 1959, p. 622-628.

10812 Small Angle Scattering From Dislocations in Deformed Single Crystals. It is shown that in spite of the occurrence of double Bragg scattering effects small angle scattering of X-rays from dislocations in cold-worked crystals should be observable, provided face-centered cubic crystals deformed in tension at low tempearture are used. ***Alfred K. Seeger.*** *Journal of Applied Physics*, v. 30, May 1959, p. 629-637.

10813 Small-Angle Scattering of X-Rays and Neutrons From Deformed Metals. X-rays or thermal neutrons may be scattered at small angles from deformed metals due both to "true" small-angle scattering and to double Bragg reflections. These two effects are discussed theoretically and compared to see how one may be distinguished from the other in the results of experimental observations. ***H. H. Atkinson.*** *Journal of Applied Physics*, v. 30, May 1959, p. 637-645.

10814 Small-Angle Scattering of X-Rays From Neutron Irradiated Copper. The scattering of X-rays at small angles from polycrystalline Cu is found to increase when the recrystallized metal is bombarded with fast neutrons. The observed effects above 2° are due to double Bragg reflections; below about 1½° they can be explained in terms both of double reflections and "true" small-angle scattering. The results indicate that either small coherent regions (of diameter about 100 Å) or severe strains are present in the irradiated metal. The results are consistent with other measurements (particularly of mechanical properties) on irradiated metals. ***H. H. Atkinson, R. E. Smallman, and K. H. Westmacott.*** *Journal of Applied Physics*, v. 30, May 1959, p. 646-649.

10815 Study of X-Ray Scattering From Fatigued Metals. Various explanations have been put forward to account for the low angle X-ray scattering from cold worked metals. The experimental results obtained by an examination of individual grains of polycrystalline fatigue specimens indicate that double Bragg reflection plays an important role in this phenomenon. The fatigue process resulted in the formation of subgrains, the misorientations within a grain amounting to 15°. ***K. Thomas and A. Franks.*** *Journal of Applied Physics*, v. 30, May 1959, p. 649-655.

10816 On the Mechanism of the Small Angle X-Ray Scattering From Cold-Worked Metals. The characteristic small angle X-ray scattering from cold worked polycrystalline foils of Cu, Al, and Ni is found to appear immediately when the foil is stretched in the X-ray beam at liquid air temperature. The scattering at a fixed angle is a reversible function of foil temperature as long as recrystallization temperatures are not exceeded. ***R. H. Neynaber, W. G. Brammer, and W. W. Beeman.*** *Journal of Applied Physics*, v. 30, May 1959, p. 656-661.

10817 Experiments on Double Bragg Reflections in Deformed and Undeformed Metal Foils. Observations of X-ray scattering from deformed and undeformed metal foils using an evacuated film chamber give evidence of double Bragg reflections. Experiments have been done on single crystals and polycrystalline foils of Al and Cu and also on an annealed powder sample of Cu. ***H. Fricke and V. Gerold.*** *Journal of Applied Physics*, v. 30, May 1959, p. 661-667.

10818 Small Angle X-Ray Scattering From Copper and Aluminum Under Cyclic Stress. Cu and Al samples were subjected to cyclic stress and run to fatigue while being held in an X-ray beam. Small angle scattering intensities were recorded at various stages of the fatigue life. These intensities were found to increase with the number of elapsed stress cycles. ***J. C. Grosskreutz and F. R. Rollins.*** *Journal of Applied Physics*, v. 30, May 1959, p. 668-674.

10819 On the Kinetics of Quenched-in Lattice Vacancies in Platinum. From quenching experiments the activation energy for vacancy formation in high purity Pt is found to be 1.20± 0.04 ev. Annealing behavior after quenching is studied. First-order annealing is found when the concentration of quenched-in defects is low; the migration energy turns out to be 1.48±0.08 ev. The annealing kinetics are not simple if the quenching temperature is high and the concentration of defects at least 10^{-4}. ***G. L. Bacchella, E. Germagnoli, and S. Granata.*** *Journal of Applied Physics*, v. 30, May 1959, p. 748-752.

10820 Interdiffusion in Binary Ionic Semiconductors. Interdiffusion in a nondegenerate, exhaustion range, binary ionic semiconductor is investigated using the recently improved theory for the concentrations of defects in crystals and Wagner's phenomenological flow equation. The removal of the restriction to an exhaustion range semiconductor and the replacement of the basic assumption of local electroneutrality are discussed. ***R. F. Brebrick.*** *Journal of Applied Physics*, v. 30, June 1959, p. 811-815.

10821 On the Crystal Perfection of Iron Whiskers. The density and distribution of dislocations in tip-grown iron whiskers produced by the hydrogen reduction of liquid iron halide salts was measured by means of X-ray rocking curves. The data show that the more perfect whiskers have dislocation

densities below 10^6 dislocation lines per cm^2. Thus, many of these whiskers which are less than 10μ in diameter contain, at most, only a small number of dislocations and behave as perfect crystals. ***Paul D. Gorsuch.*** *Journal of Applied Physics*, v. 30, June 1959, p. 837-842.

10822 On the Determination of Preferred Orientations. Orientations of individual grains in cold-rolled and annealed Si-Fe strip are obtained for a single-component texture and a multiple-component texture to determine the preferred orientations in the two textures and some information on the nature of formation of the textures. A set of three axis density figures and a (100) pole density figure are synthesized for the multi-component texture. ***C. G. Dunn.*** *Journal of Applied Physics*, v. 30, June 1959, p. 850-857.

10823 Stress-Assisted Precipitation on Dislocations. The kinetic theory for the rate of stress-assisted precipitation on dislocations is re-examined. Two approximate expressions are used for the elastic interaction between a solute atom and edge and screw dislocations. Complete precipitation curves are obtained for a regular array by combining the short- and long-time results, and it is shown that these are changed but slightly if the array is random. ***Frank S. Ham.*** *Journal of Applied Physics*, v. 30, June 1959, p. 915-926.

10824 Etching Reagents for Dislocations in Metal Crystals. General methods and precautions. Data sheet lists recommended etching solutions and times for various metals, and shows some typical results. ***L. C. Lovell, F. L. Vogel, and J. H. Wernick.*** *Metal Progress*, v. 75, no. 5, May 1959, p. 96 + 3 pages.

10825 Electron Metallography. Some Modern Techniques. Replicas; resolution and contrast; shadowcasting; special techniques; bulk specimen methods; reflection, emission, and scanning microscopy. Direct transmission methods; substructures and dislocations; direct and indirect resolution of the lattice; multiphase systems. ***R. I. Garrod and J. F. Nankwell.*** *Metal Treatment and Drop Forging*, v. 26, Mar. 1959, p. 95-102.

10826 A New Silicide in a 12 Per Cent Chromium Steel. In the course of an investigation into the tempering characteristics of a 12% Cr steel (C 0·098, Mn 3·18, Si 3·02, Ni 4·06, Cr 12·56, Mo 0·49, V 1·09%) a new phase was discovered. This phase (called *H*-phase) could not be obtained in isolation but was always associated with $M_{23}C_6$. A residue extracted after tempering the steel for 50 hrs. at 750 C, however, gave the maximum proportion of the new phase to $M_{23}C_6$. This was of the order of 2:1. ***H. Hughes.*** *Nature*, v. 183, May 30, 1959, p. 1543-1544.

10827* Effect of Lithium, Zinc, and Manganese on the State of the Crystal Lattice of Aluminum. Introducing up to 2% Li and Zn in Al caused a decrease of the interatomic bonding forces. At higher temperatures, Li increases the dimensions of the lattice of the solid solution more intensively than Zn. Only static deformations of the lattice of the Al-Li alloy take place when the strength increases. (*In Russian.*) Vliianie litiia, tsinka i magniia na sostoianie kristallicheskoi reshetki aliuminiia. ***N. I. Varich.*** *Nauchnye Doklady Vysshei Shkoly, Metallurgiia*, 1959, no. 1, p. 182-188.

10828* Critical Degree of Stretching and Formation of Coarse Grains in Zinc Containing Traces of Alloys. Recrystallization diagrams revealed the effect of traces of alloying elements on the displacement of the temperature of recrystallization. An increasing effect in the Hg, Al, Cu, Cd, Li, Mg series was found although the atomic radius difference increases from Cu through Al, Cd, Hg, Li, to Mg. (*In German.*) Kritischer Reckgrad und Grobkornbildung von Zink mit Legierungsspuren. ***Friedrich Erdmann-Jesnitzer and Günther Wieghardt.*** *Neue Hütte*, v. 4, Mar. 1959, p. 152-158.

10829 On the Influence of Volume Effects on Order-Disorder Transitions. The influence of the differences in atomic radii of the constituent atoms and in potential energies of various possible pairs of atoms was studied in a simplified model of a binary substitutional alloy. The theory is developed for linear, simple cubic, and body centred cubic lattices, and it is found that the order-disorder transition in the three-dimensional lattices can be either first or second order depending on differences between various potential energies. ***A. W. Ross and D. Ter Haar.*** *Physica*, v. 25, May 1959, p. 343-356.

10830 Surface Properties of Etched Tungsten Single Crystals. An examination of the surface properties of chemically etched W single crystals was made to determine the possibility of developing a macroscopic surface with adsorption properties equivalent to an ideal crystal plane. ***F. L. Hughes, H. Levinstein, and R. Kaplan.*** *Physical Review*, v. 113, 2nd ser., no. 4, Feb. 15, 1959, p. 1023-1028.

10831 Precipitation From Solid Solution. General theory, mechanism and kinetics; precipitation hardening-base alloys, precipitation reactions in irons and low-alloy steels, and in iron-base alloys; precipitation hardening of Cu alloys; some age-hardening characteristics of Ni-Cr alloys (Ni-rich) containing Al and Ti; precipitation in Co-base alloys. ***R. F. Mehl, et al.*** 517 pp. 1959. American Society for Metals, Cleveland. (TN673 Am35p)

10832 Electron Microscope Investigations of Alloy Nimonic 90 With Good High-Temperature Characteristics. A study of the effects of short time annealing processes on the fine structure of Nimonic 90 hardened by precipitation. Above the normal hardening temperature the hardening elements Ti + Al precipitate as small particles of the intermetallic compound $Ni_3(Ti, Al)$. With increase of the temperature and annealing time, first there is coagulation, then solution of the precipitate. The hardness decreases when the annealing temperature increases. (*In German.*) Elektronenoptische Untersuchungen an der warmfesten Legierung Nimonic 90. ***Th. Geiger and R. Kollrack.*** *Schweizer Archiv für Angewandte Wissenschaft und Technik*, v. 25, Apr. 1959, p. 111-116.

10833* A Contribution to the Effect of Arsenic Upon Structure, Graphitization and Properties of Cast Iron. As only changes the form of precipitated graphite. The structure of metallic matrix of cast iron is purely perlitic in the presence of As. If the content of As exceeds 0.27 per cent, As forms together with P a new component in structure that replaces phosphide eutectic. It is probable that it is formed by the phase Fe–As–P and cementite. (*In Czech.*) Příspěvek k vlivu arsenu na strukturu, grafitisaci a vlastnosti šedé litiny. ***Ivan Pavlík.*** *Slévárenství*, v. 7, no. 4, Apr. 1959; *Prace Československého Výzkumu Slévarenského*, v. 6, no. 4, Apr. 1959, p. 159-166.

10834* Study of Carbides in Commercial Special Steels by Electrolytic Isolation. VII. On Carbides in Tungsten High Speed Steels. (*In Japanese and English.*) ***Tomoo Sato, Taiji Nishizawa, and Kousuke Murai.*** *Tetsu to Hagane (Journal of the Iron and Steel Institute of Japan)*, v. 45, no. 4, Apr. 1959, p. 409-415.

10835* On the Function of Nitrogen as an Alloying Element in Heat-Resisting Materials. II. Aging of 16-15-6 Type Alloys. (*In Japanese and English.*) ***Masazō Okamoto, Ryōhei Tanaka, Akira Sato, and Takeo Ishizuka.*** *Tetsu to Hagane (Journal of the Iron and Steel Institute of Japan)*, v. 45, no. 4, Apr. 1959, p. 423-432.

10836* Charts for Determination of Crystal Orientation by Surface Traces in Cubic Crystals. ***Sakae Takeuchi, Toshio Honma, and Susumu Ikeda.*** *Tôhoku University, Science Reports of the Research Institutes, Ser. A. Physics, Chemistry, Metallurgy*, v. 11, no. 2, Apr. 1959, p. 81-93.

10837* Research on the Structure and Low-Temperature Annealing Effect in Cold-Rolled α-Brass. I. Structure and Change in Hardness. Specimens were annealed at 150, 250, 350, and 450° for 5 min. to 24 hrs. The hardness change by annealing was considered to be related to the structures as ready-to-finish annealed and as cold-rolled. It appears that the hardness does not vary simply with rolling reduction or grain size, but is more complicatedly influenced by the development degree of the rolling structure or by the condition of specimens such as the composition. ***Osamu Izumi.*** *Tôhoku University, Science Reports of the Research Institutes, Ser. A. Physics, Chemistry, Metallurgy*, v. 11, no. 2, Apr. 1959, p. 120-130.

10838 Solid State Diffusion. Method for making junctions in Si by solid state diffusion. Procedure employs a fused silica tube extended through two controlled temperature zones. A

carrier gas, such as He or A, is filled with an impurity from either Group III or Group V of the periodic chart of the elements. At elevated temperatures, a solid state diffusion occurs when the impurity elements contact the Si surface. ***I. Berman.*** *U. S. Air Force, Cambridge Research Center, AFCRC-TN-58-596,* Dec. 1958, 21 pp. (TK7800 Un3.12c Contin.)

METALS—POWDER

10839 Cemented Boride Composites for Tool Bits. Studies of alloys in the Ni-TiB_2 and Fe-AlB_{12} systems. ***William Pollack and Robert H. Read.*** *ASTE Research Report No.* 13, Aug. 15, 1958, 61 pp. (TJ1186 Am35r Contin.)

10840* Carbides, Silicides and Borides of High Melting Point. UC and mixtures of UC with TiC, ZrC, VC, NbC, TaC, Cr_3C_2, Mo_2C, WC, and ThC were prepared by hot-pressing. UC forms a series of solid solutions with ZrC, NbC, TaC, or ThC. Between UC and TiC or VC, a gap of miscibility occurs. Double carbides of U and Cr, Mo, or W were found to be of isotopic structure. (*In German.*) Hochschmelzende Karbide, Silizide und Boride. ***H. Nowotny, R. Kieffer, F. Benesovsky, and E. Laube.*** *Acta Chimica Academiae Scientiarum Hungaricae,* v. 18, nos. 1-4, 1959, p. 35-44.

10841* Obtaining Chromium Carbides. Formation of Cr_3C_2 and Cr_7C_3 by the reduction of chromium oxide with lampblack in a hydrogen atmosphere. The optimal operating conditions for the formation of Cr_3C_2 and Cr_7O_3 were determined. It has been found that $Cr_{23}C_7$ cannot be obtained by this method. (*In Russian.*) Oderzhannia karbidiv khromu. ***T. Ia. Kosolapova and G. V. Samsonov.*** *Akademiia Nauk Ukrains'koi RSR, Dopovidi,* 1959, no. 3, p. 298-300.

10842 Effect of Sintering Temperature on Properties of Iron-Nickel-Aluminum Powder Alloys. Study of merits of sintering above the melting point of the finished product, in a search for ways and means of accelerating the sintering of powder-metallurgy alloys. Experimental procedure and results of microexamination of specimens after sintering at different temperatures and for different times. Coercivity, resistivity, residual induction, saturation, and density of alloy as function of sintering temperature and time; best sintering temperature for magnetic properties. ***A. B. Al'tman.*** *Henry Brutcher Translation No.* 4444. 8 pp. (From *Metallovedenie i Obrabotka Metallov,* no. 12, Dec. 1958, p. 17-20.) Henry Brutcher, Altadena, Calif.

10843 Endurance Limit of Sintered Tungsten Carbides With Cobalt as Binder. Variation of endurance limit of WC-Co carbides with Co content (4-8%) and WC particle size, at room and elevated temperatures. Correlation with variations in transverse rupture and impact strengths. ***G. S. Kreimer, I. I. Sidorin, and E. F. Tishchenkova.*** *Henry Brutcher Translation No.* 4508, 10 pp. (From *Izvestiya Akademii Nauk SSSR, Otd. Tekh. Nauk,* Mar. 1958, no. 3, p. 113-118.) Henry Brutcher, Altadena, Calif.

10844* Powder Metallurgy in Reactor Technology. Products can be made by powder-metallurgical methods which have properties unobtainable by other fabrication processes. Reviews methods for producing fuels and structural materials for reactors, such as hydrostatic pressing for cylindrical elements, hot-pressing for nonporous refractory structures, and sintering of U compounds. Uranium carbide and oxide structures have been fabricated which have good stability, creep, and corrosion properties at elevated temperatures. (*In German.*) Die Pulvermetallurgie in der Reaktortechnik. ***R. Palme.*** *Metall,* v. 13, May 1959, p. 386-389.

10845* Molded Sections of Powder Metallurgical Origin, Especially Strip Made of Zinc and Zinc-Lead Alloys. Sinters and strips of Zn and Zn-Pb powder mixtures with up to 10 weight per cent Pb are studied relative to their mechanical properties, improvement by subsequent rolling, conditions of recrystallization, and resistance to corrosion in a 3% aqueous common salt solution. (*In German.*) Pulvermetallurgisch hergestellte Formkörper, insbesondere Bänder, aus Zink und Zink-Blei-Legierungen. ***H. Weik, G. Ogiermann, and R. Ergang.*** *Metall,* v. 13, May 1959, p. 398-404.

10846* Strong Tough Cermets. Development of lamellar materials by hot pressing thin alternate layers of 90 TiC-10 Ni cermet and flat, annealed Ni strips. ***Thomas S. Shevlin.*** *News in Engineering at Ohio State University,* v. 31, no. 2, Apr. 1959, p. 17 + 3 pages.

10847* Cermet Body Nondestructive Test Data Evaluated by Spin Tests of Blades and Bend Tests of Bars. High-quality cermet blades, previously screened by surface inspections for flaws, were re-inspected at the root by means of several flaw-detection and property-measurement tests. Strengths of these roots were determined by short-time room-temperature spin testing to fracture. ***A. G. Holms and A. J. Repko.*** *Nondestructive Testing,* v. 17, no. 3, May-June 1959, p. 156-164.

10848* The Sintering Behavior of Tungsten. Tests showed that Ni and Co additions increase the reactivity during sintering. Small Ni additions (0.25%) with sintering for 1 hour at 1300 C resulted in almost pore-free W samples. Nickel dissolves very rapidly in W. (*In German.*) Über die Beeinflussung des Sinterverhaltens von Wolfram. ***J. Vacek.*** *Planseeberichte für Pulvermetallurgie* v. 7, no. 1, Apr. 1959, p. 6-17.

10849* Rare-Earth Hardmetals. Surveys rare-earth-metal carbides, nitrides, borides, and silicides. Hot-pressed GdB_6 and $DySi_2$ were investigated as to structure and physical and scaling properties. ***I. Binder and R. Steinitz.*** *Planseeberichte für Pulvermetallurgie,* v. 7, no. 1, Apr. 1959, p. 18-21.

10850* Zone Sintering. The technique is analogous to that of zone melting and consists of steadily passing a furnace at the sintering temperature (i.e. below the melting point of the material) over the "green ware". The hot zone extends only over part of the bar at any given time and is made to transverse the length of the bar. ***J. Antill and M. Gardner.*** *Powder Metallurgy, nos.* 1/2, 1958, p. 133-142.

10851* Recent Developments in the Field of Silicides and Borides of the High-Melting-Point Transition Metals. ***R. Kieffer and F. Benesovsky.*** *Powder Metallurgy,* nos. 1/2, 1958, p. 145-171.

10852* Bonding in Carbides, Silicides, and Borides. The hypothesis that many of the properties of the transition metals, their alloys, and their compounds can be understood in terms of a relationship between the coordination of the metal atoms and the number of bonding electrons per atom, is applied to transition metals of Groups IV_A, V_A, and VI_A. The crystal structure and stability of the carbides can be satisfactorily explained on the basis of electron concentration. The ability of B to form strong B-B bonds is important in the borides, and the metal-metal coordination would appear to be of only secondary importance. ***D. A. Robins.*** *Powder Metallurgy,* nos. 1/2, 1958, p. 172-188.

10853* The Oxidation of Zirconium Carbide in High-Temperature Combustion Gases. The reactions of sintered Zr and Ti carbides were studied in simulated rocket combustion gases at surface temperatures of about 2250 C. Under these conditions ZrC is oxidized according to a parabolic law owing to the formation of an adherent oxide film. No oxide film is formed on TiC under the same conditions, and it decreases in weight and dimensions at a relatively rapid rate. ***W. Watt.*** *Powder Metallurgy,* nos. 1/2, 1958, p. 227-234.

10854* The Compaction of Metal Powders by Rolling. I. The Properties of Strip Rolled From Copper Powders. II. An Examination of the Compaction Process. ***P. E. Evans and G. C. Smith.*** *Powder Metallurgy,* no. 3, 1959, p. 1-44.

See also: **10666** (oxidation of TiC and TiB_2).

NONDESTRUCTIVE TESTING AND QUALITY CONTROL

10855 Applied Radiation Performs for Metalworking. When nuclear research is put to work at detecting, locating, and measuring jobs, that is applied radiation. It can be both

powerful and sensitive, and it often does jobs that are impossible any other way. This roundup notes proven techniques, recent developments, and possibilities for the future. ***Charles Emerson.*** *American Machinist*, v. 103, May 4, 1959, p. 91-92.

See also: **10847** (inspection of cermet turbine blades); **10870** (nondestructive testing of nuclear reactors).

NUCLEAR PHYSICS, NUCLEONICS, AND RADIATION

10856* The Gas-Cooled, Graphite-Moderated Reactor and the Water-Cooled, Water-Moderated Reactor as Power Systems. A survey of the reports made at the Second International Conference on the Peaceful Use of Atomic Energy, concerning these types of reactors, with emphasis on the diversity of methods used to develop nuclear energy, such as the successive creation of reactors of the first, second, or third types in England. (*In Russian.*) Atomnye elektrostantsii s grafito-gazovymi i vodo-vodianymi reaktorami. ***Iu. I. Koriakin.*** *Atomnaia Energiia*, v. 6, no. 4, Apr. 1959, p. 369-381.

10857 Stainless Steel-Uranium Dioxide Fuel Components for Army Package Power Reactor. This paper covers the design, manufacture, and operation characteristics of the fuel components developed for the Army Package Power Reactor. The technological factors, such as compatibility, corrosion resistance, and irradiation behavior, which led to the selection of UO_2 as the fuel dispersant, B_4C as the burnout poison, and austenitic stainless steel as the cladding and matrix material, are reviewed. ***J. E. Cunningham and R. J. Beaver.*** Paper from "Nuclear Metallurgy. v. V. Ceramic Base Elements; Metal Base Fuels and Jacket Components", American Institute of Mining, Metallurgical and Petroleum Engineers, New York. 1958, p. 29-40. (TN697 Am35n5)

10858 Preparation of Zirconium-Base Dispersion Fuels. The paper describes the techniques used in making cylindrical irradiation samples of dispersion-type alloys. These techniques involve the preparation of high-quality Zr alloy powders, preparation of spherical particles of fissile materials, and final consolidation of these two types of materials into samples for irradiation tests. Metallographic examination and other data on the fuel materials are given. ***A. P. Beard and R. N. Honeyman.*** Paper from "Nuclear Metallurgy. v. V. Ceramic Base Elements; Metal Base Fuels and Jacket Components", American Institute of Mining, Metallurgical and Petroleum Engineers, New York. 1958, p. 41-47. (TN697 Am35n5)

10859 Fabrication and Properties of Uranium-Zirconium Hydride Fuel Elements for Triga Reactors. The melting, casting, extrusion, and machining of 8 wt pct U and 92 wt pct Zr alloy are described; the assembly of the hydrided alloy into a fuel element is described. ***W. P. Wallace, M. T. Simnad, and B. Turovlin.*** Paper from "Nuclear Metallurgy. v. V. Ceramic Base Elements; Metal Base Fuels and Jacket Components", American Institute of Mining, Metallurgical and Petroleum Engineers, New York. 1958, p. 49-55. (TN697 Am35n5)

10860 Silicon-Modified Uranium-Aluminum Alloys for Foreign Reactor Applications. The addition of small amounts of Si to U-Al alloys suppresses the formation of UAl_4 producing striking changes in the fabrication qualities of the fuel material. The effects of Si additions of U-Al alloys in the range of compositions (40 to 50 pct U) required for applications where the U-235 isotopic enrichment is limited to 20 pct are discussed in terms of casting, billet rolling, and composite fuel-plate fabrication. Particular attention is directed toward the control of the dog-bone and effects in roll-bonded fuel plates and component assembly problems peculiar to the novel materials combinations employed. Data are also presented on the mechanical and physical properties of modified U-Al alloys. ***W. C. Thurber and R. J. Beaver.*** Paper from "Nuclear Metallurgy. v. V. Ceramic Base Elements; Metal Base Fuels and Jacket Component", American Institute of Mining, Metallurgical and Petroleum Engineers, New York. 1958, p. 57-62. (TN697 Am35n5)

10861 Manufacture of EBR-1, Mark III Fuel and Blanket Elements. The fuel elements and blanket elements for the EBR-1, Mark III core loading are round rods nominally 0.403-in. ± 0.001-in. diam by 21,750-in. long. Both types are identical in external appearance and size. The U-bearing section is 19.812-in. long. This zone is a single section of normal U in the blanket rods. Fuel rods contain an 8.500-in. central section (approximately) of U enriched to 92.5 pct U^{235} flanked at each end by normal U sections. ***R. A. Noland, N. J. Carson, C. C. Stone, F. D. McCuaig, and R. E. Macherey.*** Paper from "Nuclear Metallurgy. v. V. Ceramic Base Elements; Metal Base Fuels and Jacket Components", American Institute of Mining, Metallurgical and Petroleum Engineers, New York. 1958, p. 77-84. (TN697 Am35n5)

10862* Scattering of μ-Mesons in Lead. Shows that after introduction of all relevant corrections the experimental data satisfactorily agree with the calculations. ***A. I. Alikhanian and F. R. Arutyunian.*** *Nuclear Physics*, v. 10, no. 3, Mar. 1959, p. 244-255.

10863* The Energy and Angular Distribution of Protons From 14 MeV Neutron Reactions With Fe^{54}. The Fe^{54} angular distributions and previously published angular distributions for Cu have been corrected to the center of mass system of coordinates and compared. ***D. L. Allan.*** *Nuclear Physics*, v. 10, no. 4, Apr. 1959, p. 348-359.

10864* On the Decay of ^{67}Ge. A tentative decay scheme is proposed which incorporates the levels in ^{67}Ga known from other work. ***R. A. Ricci and R. Van Lieshout.*** *Nuclear Physics*, v. 10, no. 4, Apr. 1959, p. 360-372.

10865* Radiative Corrections to Bremsstrahlung. Second order corrections were evaluated by a straightforward application of Feynman-Dyson techniques, taking all the possible effects into account. The cross-section for double bremsstrahlung has also been evaluated in various limits, in order to cancel out the "infra-red" terms appearing in the second order corrections. ***A. N. Mitra, P. Narayanaswamy, and L. K. Pande.*** *Nuclear Physics*, v. 10, no. 6, May 1959, p. 629-653.

10866* A Theoretical Approach to Low Energy Pion Physics. Proposes a new approach for the study of problems involving low energy pions. The method starts from a determination of the pion-nucleon scattering state vector in terms of the physical nucleon state vector and of the renormalized coupling constant. Such a determination can be performed in the one-meson approximation and leads in a simple and natural way to the same results as the Chew and Low approach to scattering and photoproduction. ***B. Bosco, S. Fubini, and A. Stanghellini.*** *Nuclear Physics*, v. 10, no. 6, May 1959, p. 663-687.

10867* A UO_2-Liquid Metal Slurry Reactor for Economic Power. An application of a UO_2-liquid metal slurry reactor to a stationary power station is described. The fuel, consisting of a UO_2 suspension in liquid Bi, is pumped through a moderator matrix and an external heat exchanger. Low initial enrichment, long fuel life, and low fuel fabrication costs, combined with a low-pressure reactor, indicate a competitive electrical generation cost. The use of natural U feed in one of the modes of operation of this reactor system is shown to be possible. Experiments on the dispersion of UO_2 in Bi are reported. ***J. K. Davidson, W. L. Robb, O. N. Salmon, and J. B. Sampson.*** *Nuclear Science and Engineering*, v. 5, Apr. 1959, p. 227-236.

10868 Second United Nations International Conference on the Peaceful Uses of Atomic Energy, Proceedings. v. IV. Production of Nuclear Materials and Isotopes. v. XXIII. Experience in Radiological Protection. v. XXX. Fundamental Physics. v. XXXI. Theoretical and Experimental Aspects of Controlled Nuclear Fusion. United Nations, Geneva. 1958. v. IV. 631 pp.; v. XXIII. 453 pp.; v. XXX, 329 pp.; v. XXXI, 390 pp. (QC770 In8p2 Over.)

10869 Containment of Fragments From Runaway Reactor. Considerable amount of attention has been given to the penetration of steel plate by long rods. Also reports on progress in devising energy sources that will simulate energy release during reactor runaway. ***N. R. Zabel.*** *Stanford Research Institute. Technical Report No.* 2, Oct. 1, 1958, 54 pp. (QC125 St24t Contin.)

10870 Nondestructive Testing of EBR-I Mark III Fuel Elements and Components. Ultrasonic and eddy current methods were used to inspect for: (a) homogeneity of the casting, (b) bonding of the core to the clad on the extruded rod, (c) bonding of the Zircaloy spacer disk to the uranium, and (d) cracks in the Zircaloy rod used for end caps. ***W. N. Beck, et al.*** *U. S. Atomic Energy Commission, ANL-5893*, May 1959, 35 pp. (UF767 Un3.1an Contin.)

10871 Final Specifications for Government-Purchased Equipment for Argonne Low Power Reactor (ALPR). ***E. E. Hamer and H. H. Hooker.*** *U. S. Atomic Energy Commission, ANL-5998*, May 1959, 195 pp. (UF767 Un3.1an Contin.)

10872 Lecture Notes on Reactor Shielding. Includes the basic information necessary to enable one to compute neutron and gamma-ray flux distributions in an unperturbed shield. ***M. Grotenhuis.*** *U. S. Atomic Energy Commission, ANL-6000*, Mar. 1959, 184 pp. (UF767 Un3.1an Contin.)

10873 Control Aspects of Very High Flux Research Reactors. Computation of reactor characteristics over a fuel cycle in a way suitable to the investigation of the control aspects of the reactor problem. Study of the dynamic problem including as independent variables the neutron energy, the space, and time. ***A. C. Vianna.*** *U. S. Atomic Energy Commission, ANL-6008*, May 1959, 95 pp. (UF767 Un3.1an Contin.)

10874 Klein-Nishina Photon Cross Sections (Program Gamma). Cross sections for use in γ-heating calculations in reactor cores have been calculated and tabulated. ***M. J. Stanley.*** *U. S. Atomic Energy Commission, APEX-487*, May 1959, 36 pp. (UF767 Un3.1ap Contin.)

10875 RBU Calculation of Reactor History Including the Details of Isotopic Concentration. I. The Method. Digital computer program for the detailed calculation of the neutron, reactivity, and isotopic history of a reactor. ***E. J. Leshan, et al.*** *U. S. Atomic Energy Commission, ASAE-34*, Dec. 1, 1958, Sections individually paged. (UF767 Un3.1as Contin.)

10876 Liquid Metal Fuel Reactor Experiment Quarterly Technical Report. October-December 1957. *U. S. Atomic Energy Commission, BAW-1041*, Oct.-Dec. 1957. (UF767 Un3.1ba Contin.)

10877 Reprocessing of Power Reactor Fuels. The Enrico Fermi Fast Breeder Reactor Fuel Progress Report No. 2. ***C. W. Pierce, et al.*** *U. S. Atomic Energy Commission, BNL-549* (T-144), Mar. 1959, 6 pp. (UF767 Un3.1bn Contin.)

10878 Nuclear Physics Research Quarterly Report, October, November, December 1958. Papers on subthreshold fission, reactor lattice, critical mass, and theoretical physics. ***John E. Faulkner, et al.*** *U. S. Atomic Energy Commission, HW-59126*, Jan. 20, 1959, 124 pp. (UF767 Un3.1hw Contin.)

10879 The Specific Activity and Half-Life of Np^{237}. ***F. P. Brauer, et al.*** *U. S. Atomic Energy Commission, HW-59642*, Mar. 13, 1959, 6 pp. (UF767 Un3.1hw Contin.)

10880 ETR Hazard Analysis of the KAPL-Flow Experiment. The experimental system and types of test specimens as well as safety features of the system are described. ***R. J. Flygare.*** *U. S. Atomic Energy Commission, IDO-16507*, Dec. 18, 1958, 52 pp. (UF767 Un3.1id Contin.)

10881 Operation of the MTR on a Plutonium Loading. ***D. R. deBoisblanc and R. C. Marsden.*** *U. S. Atomic Energy Commission, IDO-16508*, Dec. 22, 1958, 28 pp. (UF767 Un3.1id Contin.)

10882 Test Reactors Meeting for Industry, May 13-15, 1959. Deals with the construction, operation, and utilization of test reactors. *U. S. Atomic Energy Commission, IDO-16520*, 339 pp. (UF767 Un3.1id Contin.)

10883 A Preliminary Study of the Turret Experiment. An Operating Test of Unclad Fuel at High Temperature. Preliminary study of an impregnated graphite reactor to produce He at 2400 F for process heat uses. ***R. P. Hammond and J. P. Cody, editors.*** *U. S. Atomic Energy Commission, LA-2303*, Apr. 17, 1959, 91 pp. (UF767 U3La Contin.)

10884 Concerning Resonant Beam Knock-Out From an A-G Synchrotron. The efficacy of various types of field-index perturbations (n-bumps) in effecting an instability potentially helpful for beam utilization is examined analytically for an alternating-gradient particle accelerator. ***L. Jackson Laslett and Charles L. Hammer.*** *U. S. Atomic Energy Commission, MURA-445*, Feb. 2, 1959, 78 pp. (UF767 Un3.1mu Contin.)

10885 Development of the SRE Mark I Safety Rod. Design, development, and testing is reported. ***E. C. Phillips.*** *U. S. Atomic Energy Commission, NAA-SR-2008*, Jan. 1, 1959, 40 pp. (UF767 Un3.1na Contin.)

10886 A Remotely Maintainable Rectilinear Manipulator for the Processing Refabrication Experiment (PRE). Description is given of the modifications to a commercially available rectilinear manipulator which were required to facilitate the remote removal, replacement, and maintenance of the manipulator and its major components. The feasibility of the PRE modifications and operating and maintenance techniques were satisfactorily demonstrated. ***G. P. Streechon.*** *U. S. Atomic Energy Commission, NAA-SR-3265*, Mar. 15, 1959, 38 pp. (UF767 Un3.1na Contin.)

10887 The Lead-Glass Viewing Window in the Processing Refabrication Experiment. Design data and features incorporated in the all-glass radiation-shielding window designed for a PRE facility and the techniques for servicing components of the window assembly. The PRE shielding window was designed so that all in-cell components can be replaced by the in-cell crane. An in-cell cover glass gasketed to the cell liner prevents a loss of cell atmosphere during the replacement operation. ***G. Gustovich.*** *U. S. Atomic Energy Commission, NAA-SR-3267*, May 1959, 31 pp. (UF767 Un3.1na Contin.)

10888 The ORNL Thermonuclear Program. Sherwood Project. *U. S. Atomic Energy Commission, ORNL-2457*, Jan. 15, 1959, 168 pp. (UF767 U3o Contin.)

10889 Tables of Isotope Effect Functions for Homocompetitive First-Order Reactions. ***M. H. Lietzke and Clair J. Collins.*** *U. S. Atomic Energy Commission, ORNL-2678*, May 11, 1959, 40 pp. (UF767 U3o Contin.)

10890 Thermonuclear Project Semiannual Report for Period Ending January 31, 1959. This document describes the progress of the ORNL Thermonuclear Program, the "Sherwood Project". Work is still largely devoted to the Direct Current Experiment (DCX), although some conceptual work has been done on the second stage, the DCX-2. *U. S. Atomic Energy Commission, ORNL-2693*, May 19, 1959, 112 pp. (UF767 U3o Contin.)

10891 A Program for the Calculation of Maxwell-Boltzmann Averaged Cross Sections on the IBM-704 Computer. ***C. W. Nestor.*** *U. S. Atomic Energy Commission, ORNL-2694*, May 18, 1959, 7 pp. (UF767 U3o Contin.)

10892 Sixteen Lectures on Controlled Thermonuclear Reactions. Lectures dealt primarily with the theory of operation of a proposed thermonuclear reactor using the so-called "magnetic mirror" principle. ***R. F. Post.*** *U. S. Atomic Energy Commission, UCRL-4231*(Del.), Feb. 2, 1954, 133 pp. (UF767 U3u Contin.)

10893 Neutron Activation Cross Sections. The nuclides studied were Hf^{180}, Ta^{181}, W^{186}, Au^{197}, and Th^{232}. The neutron energy range covered was from 31 kev to 6 Mev. ***J. A. Miskel, K. V. Marsh, M. Lindner, and R. J. Nagle.*** *U. S. Atomic Energy Commission, UCRL-5454*, Jan. 1959, 11 pp. (UF767 U3u Contin.)

10894 Pulsed Neutron Source Studies of Graphite-Enriched Uranium Systems. The value of the decay constant has been found for several bucklings near critical for each of five fuel concentrations. The variation of the decay constant with buckling and fuel concentration is qualitatively discussed. ***Fred A. Kloverstrom and Ted T. Komoto.*** *U. S. Atomic Energy Commission, UCRL-5477*, Feb. 5, 1959, 24 pp. (UF767 U3u Contin.)

10895 A Proposal for Determining the Electromagnetic Form Factor of the Pion. Extrapolation of the cross section for $e^- + p \rightarrow n + \pi^+ + e^-$ method. ***William Robert Frazer.***

U. S. Atomic Energy Commission, UCRL-8621, Feb. 4, 1959, 65 pp. (UF767 U3u Contin.)

10896 Mechanisms of the (α, pn) Reaction. Thesis on the (α, pn) nuclear reactions of several isotopes. ***Robert Joseph Silva.*** *U. S. Atomic Energy Commission, UCRL*-8678, Mar. 1959, 79 pp. (UF767 U3u Contin.)

10897 A Method for the Solidification of Radioactive Aqueous Liquid Wastes. Utilization of Portland cement, mixed with expanded vermiculite. ***John A. Kaufman and Nelson B. Garden.*** *U. S. Atomic Energy Commission, UCRL*-8684, March 13, 1959, 20 pp. (UF767 U3u Contin.)

10898 Independent Yields of Isomeric Pairs in Nuclear Reactions. The cumulative yield ratios of Cd^{115}/Cd^{115m} and Sc^{44m}/Sc^{44} were determined. ***Sylvia Mae Bailey.*** *U. S. Atomic Energy Commission, UCRL*-8710, Apr. 1959, 85 pp. (UF767 U3u Contin.)

10899 One Year of Operating Experience at Shippingport. Achievements in advance reactor technology and the practicability of nuclear central station power. *U. S. Atomic Energy Commission, WAPD-BT*-12, Apr. 1959, 188 pp. (UF767 Un3.1wb Contin.)

10900 Technical Progress Report. Pressurized Water Reactor (PWR) Project, February 24, 1959 to April 23, 1959. ***J. W. Simpson.*** *U. S. Atomic Energy Commission, WAPD-MRP*-79, 82 pp. (UF767 Un3.1wa Contin.)

10901 Reports to the AEC Nuclear Cross Sections Advisory Group. Contains an informal statement of recent developments, changes of emphasis, and preliminary data which are of importance to the cross section measurement program of the AEC. ***V. L. Sailor.*** *U. S. Atomic Energy Commission, WASH*-1018, Mar. 4-5, 1959, 66 pp. (UF767 Un3.1w Contin.)

See also: **9976** (concrete shielding); **9990** (ceramics as nuclear fuels); **10001** (stainless-steel clad UO_2 fuel elements); **10074** (reactor chemistry); **10133** (chemical analysis in reactor technology); **10153** (chemical radiation effects); **10653** (fabrication of fuel elements); **10778** (fabrication of Fe-Al-Cr fuel elements); **10779** (fabrication of Zr-clad Mo-U fuel rods); **10787** (fabrication of SRE fuel rods); **10844** (powder metallurgy applications).

OPERATIONS RESEARCH AND MANAGEMENT ENGINEERING

10902* Authority Structure and Organizational Effectiveness. An important factor in the ability of an organization to achieve its goals is its authority structure. In professional organizations, for example, traditional staff and line concepts must be reversed, since the staff "experts" are carrying out the major goal activity, while the "line" plays a service role. ***Amitai Etzioni.*** *Administrative Science Quarterly*, v. 4, no. 1, June 1959, p. 43-67.

10903* A Bibliographical Essay on Decision Making. Traces contemporary theories of decision-making and administrative practice. ***William J. Gore and Fred S. Silander.*** *Administrative Science Quarterly*, v. 4, no. 1, June 1959, p. 97-121.

10904* How Effective Are You as a Manager? Here's a simple checklist of qualities that other gas industry executives think are important. ***Ernest W. Fair.*** *American Gas Journal*, v. 186, June 1959, p. 39-40.

10905 10th Annual AIIE Conference Proceedings Manual, May 14-16, 1959, Atlanta, Georgia. The National Industrial Engineering Conference, initiated in 1959 by a group of pioneers from education and industry, has grown in size and stature as the nation's only leading forum of industrial engineering. This book comprises a complete printing of the speeches and papers at the 1959 national meeting. American Institute of Industrial Engineers, Proceedings (Annual Volume), v. 10, 271 pp. 1959. Dickson's Inc., Atlanta, Ga. (T58 Am35c Vis.)

10906 Technologists in Top Management. I. The Business Success Factor. An attempt to quantitatively relate the degree of management participation by the technologist to the financial performance of major companies. Part 2, to be published in the near future, will consider further interpretations of the factors developed. ***Kenneth M. Watson.*** *Chemical Engineering Progress*, v. 55, Feb. 1959, p. 37-44.

10907 Technologists in Management. Technologists should give more attention to a thorough understanding of business principles. ***Kenneth M. Watson.*** *Chemical Engineering Progress*, v. 55, May 1959, p. 38-40.

10908 Opportunities in Management for the Technologist. ***Ernest Hart.*** *Chemical Engineering Progress*, v. 55, May 1959, p. 41.

10909 'Bottom-Up' Management Policy Proves Worth in Seminars. This method of management distributes as much decision-making as possible all the way from the top man down to first-line supervisors. Persons at every level are encouraged to make decisions, get results through others, and play a real part in company affairs. This is the opinion of Charles H. Bell, president of General Mills' Chemical Division, Kankakee, Illinois. ***Paul Hoffman and Theodore W. Wett.*** *Chemical Processing*, v. 22, June 1959, p. 27 + 2 pages.

10910 Can You Rate Your Research? A survey of some of the best current thinking on research evaluation, what to expect of the scientific yardsticks that have been developed, and what not to expect of them. *Chemical Week*, v. 84, no. 22, May 30, 1959, p. 35.

10911 Volunteering for Top Jobs. American Maize finds its program for training volunteers from all plant operations is producing top crop of management prospects. *Chemical Week*, v. 84, no. 22, May 30, 1959, p. 64 + 1 page.

10912 The Lonely Art of Decision Making. A unique brand of courage and intelligence is required of the man who succeeds at the crucial job of decision making, says the author, former head of Inland Steel Company and adviser to presidents. ***Clarence B. Randall.*** *Dun's Review and Modern Industry*, v. 73, no. 6, June 1959, p. 47-49.

10913 Engineering and Organization. The objectives of this book are: (1) to define the goals of engineering, (2) to establish the standards by which its performance can be evaluated, and (3) to examine the means by which the know-how of engineering can be most effectively employed. ***Everett Laitala.*** 391 pp. 1959. Richard D. Irwin, Inc., Homewood, Ill. (TA190 L14e)

10914* Modernizing to Cut Costs. This is a series of five articles, with the following titles: "Creating a Climate for Ideas", "Updating Plant Buildings", "Improving Production Tools", "Finding Better Methods", and "Probing Every Plant Job". *Factory*, v. 117, June 1959, p. 74-83.

10915 Evaluating the Evaluators. The role of the consultant in new product evaluation and in the reorganization of a technical department or project is briefly summarized. ***D. B. Keyes.*** *Industrial and Engineering Chemistry*, v. 51, June 1959, p. 46A-48A.

10916 Evolutionary Operation. A method of operating a process which also tells how to improve the process by statistical evaluation. ***W. J. Youden.*** *Industrial and Engineering Chemistry*, v. 51, June 1959, p. 79A-80A.

10917 How to Prepare for Greater Business Responsibility. This is an *Iron Age* "Special Report to Management". There are opportunities in business for men who are ready for added responsibility. Many men make these important mistakes: Not preparing themselves or not evaluating their company or industry in terms of their future. ***S. M. Boyden.*** *Iron Age*, v. 183, no. 23, June 4, 1959, p. 101-103.

10918* Industrial Engineering in Hospitals. A permanent industrial engineering program will be a substantial effort toward the attainment of major objectives in the hospital and

it will be the best insurance against uncontrolled costs. ***Harold E. Smalley.*** *Journal of Industrial Engineering*, v. 10, no. 3, May-June 1959, p. 171-175.

10919* Order Sizes for Job Lot Manufacturing. A formula was derived for determining the most economical number to start in situations where non-economic considerations did not predominate. Finally, a simple procedure for calculating the optimum start size of the order was given which can be used for wide ranges of the mean of the Poisson distribution. ***R. W. Llewellyn.*** *Journal of Industrial Engineering*, v. 10, no. 3, May-June 1959, p. 176-180.

10920* A Method for Measuring Physiological Cost of Work. The possibility of the industrial engineer making decisions based on physiological costs rather than on time alone is most encouraging. The techniques described here are progressing well beyond the laboratory stage and have been used in actual work situations. ***James H. Greene, W. H. M. Morris, and J. E. Wiebers.*** *Journal of Industrial Engineering*, v. 10, no. 3, May-June 1959, p. 180-184.

10921* Work Design: A Philosophy for Applying Work Principles. Work design offers an excellent opportunity for a complete and unified program concerning work. Management now has a procedure for applying work principles which meets the requirements for all managerial functions: planning (design of original work), operating (improvement and betterment), and control (betterment), all oriented toward the objective of the ideal work system. ***Gerald Nadler.*** *Journal of Industrial Engineering*, v. 10, no. 3, May-June 1959, p. 185-192.

10922* Double Sample Estimation in Work Measurement. The purpose of this expository paper is to describe some double sample techniques which can be used to obtain estimates of some performance characteristics when the maximum allowable error can be specified in advance. Two work-measurement problems are considered. ***Morton Klein.*** *Journal of Industrial Engineering*, v. 10, no. 3, May-June 1959, p. 193-196.

10923* An Example of Work Sampling in the Hospital. A specific conclusion resulting from this study was that work sampling may be used successfully to measure work, such as nursing, in the hospital world. The more general conclusions which one may reach as a result of this work is that work sampling may be useful in areas other than the traditional industrial work place, and that work sampling can be used to measure certain types of professional activity. ***Paul E. Torgersen.*** *Journal of Industrial Engineering*, v. 10, no. 3, May-June 1959, p. 197-200.

10924* People Are Funny: Industrial Engineering and the Human Equation. Discusses ways in which industrial engineering differs from other kinds of engineering. ***Elliott DeForest.*** *Journal of Industrial Engineering*, v. 10, no. 3, May-June 1959, p. 209-211.

10925* Summary of the Industrial Engineering Symposium, Georgia Institute of Technology, November 1957. ***Cecil G. Johnson.*** *Journal of Industrial Engineering*, v. 10, no. 3, May-June 1959, p. 223-226.

10926* Human Engineering. How it began, what it is, some of the methods used, and where the future may lead. ***Harold P. Van Cott.*** *Mechanical Engineering*, v. 81, June 1959, p. 50-52.

10927* Training Young Engineers. The Engineering Training Program at Oliver Iron Mining Division is a major contribution to management development. Oliver has found that the transition from academics to industry is best bridged by employing new engineers in a variety of carefully prescribed assignments under the guidance of experienced and helpful personnel. ***R. O. Hawkanson.*** *Mining Congress Journal*, v. 45, May 1959, p. 75 + 3 pages.

10928 What Has Cybernetics To Do With Operational Research? It is possible to pursue each activity in its own right; but it is also possible to practice operational research with essentially cybernetic models, and to study cybernetics by operational research techniques. This thought is generalized into the idea that cybernetics is the science of which operational research is the method. ***Stafford Beer.*** *Operational Research Quarterly*, v. 10, no. 1, Mar. 1959, p. 1-21.

10929 Think About Those Below You Too. The manager's job has frequently been defined as "getting things done through others". If this is a fair definition, then it is obvious that a manager has to develop the leadership skills and understanding that will enable him to deal with each subordinate as a unique individual. ***Gerald F. Bassler.*** *Petroleum Engineer*, v. 31, June 1959, p. E1-E4.

10930* Fundamental Control Techniques. II. Control Charts. I. The purpose of the series is to provide an insight into some of the statistical methods useful in quality control. ***Mason E. Wescott.*** *Rubber World*, v. 140, no. 2, May 1959, p. 252-262.

10931 Combinatorial, Probabilistic and Statistical Aspects of an M x J Scheduling Problem. The assembly line scheduling problem is studied in detail from the combinatorial, probabilistic, and statistical points of view. ***J. Heller.*** *U. S. Atomic Energy Commission, NYO*-2540, Feb. 1, 1959, 93 pp. (UF767 U3ny Contin.)

10932 Proceedings of the Tenth Annual Industrial Engineering Conference, 1959. The Conference is designed to promote the dissemination of information on industrial engineering principles and techniques; looking toward increase of efficiency and reduction of costs in industrial processes. ***R. E. Shafer and R. E. Hanna, Jr., editors.*** *West Virginia University, Technical Bulletin No.* 54, May 1959, 111 pp. (TA21 W52t Contin.)

ORE AND MATERIALS BENEFICIATION

10933 The Smelting of Titaniferous Ores. Smelting has been greatly simplified by recent developments in ore beneficiation and external desulfurization of hot metal. With these modern techniques, and slag and temperature control best suited to the ore at hand, it may be concluded that the smelting of titaniferous ores is a technical possibility. ***H. U. Ross.*** Paper from "Blast Furnace, Coke Oven, and Raw Materials Committee of the Iron and Steel Division, Proceedings", v. 17, American Institute of Mining, Metallurgical, and Petroleum Engineers, New York. 1958, p. 47-64. (TN713 Am35p)

10934 Sintering of High-Grade Hematite Ore With Special Reference to Lime Additions and Reducibility. Under certain conditions it is possible to combine both strength and reducibility in the same product by adding lime. ***E. Klein.*** Paper from "Blast Furnace, Coke Oven, and Raw Materials Committee of the Iron and Steel Division, Proceedings", v. 17, American Institute of Mining, Metallurgical, and Petroleum Engineers, New York. 1958, p. 265-275. (TN713 Am35p)

10935 Fuels for Sintering. The highest sinter production rates were obtained with by-product coke breeze, stoker coke, anthracite Nos. 4 and 5, anthrafines, Alpheus coal middlings, and beehive coke. A satisfactory sinter fuel should contain a minimum of fine material and not more than approximately 5% of plus ¾-in. material. ***T. L. Myron, M. R. Faigen, and R. L. Franklin.*** Paper from "Blast Furnace, Coke Oven, and Raw Materials Committee of the Iron and Steel Division, Proceedings", v. 17, American Institute of Mining, Metallurgical, and Petroleum Engineers, New York. 1958, p. 282-293. (TN713 Am35p)

10936 Automatic Control of Flash Roasting of Zinc Concentrates. Detailed description of a system of automation of flash roasters for zinc concentrate, after a trial run in Sept. 1956, adopted on an industry-wide scale in the Soviet Union. ***I. A. Burovoi, I. M. Bernshtein, and G. M. Shteingart.*** *Henry Brutcher Translation No.* 4381, 9 pp. (From *Tsvetnye Metally*, v. 30, no. 4, 1957, p. 29-32.) Henry Brutcher, Altadena, Calif.

10937 Direct Processes for Production of Iron. Reduction of fine ores by fluidizing-reactor technology; some data on H-Iron, Esso-Research, Shipley, Novalfer-Onia, and Stelling processes. ***J. Willems.*** *Henry Brutcher Translation No.* 4499, 22 pp. (From *Stahl und Eisen*, v. 79, no. 2, 1959, p. 74-80.) Henry Brutcher, Altadena, Calif.

10938 The Elution With Carbonate Solution of an Ion Exchange Resin Loaded With Uranyl Sulphate. ***V. M. McNamara and W. A. Gow.*** *Canada, Mines Branch, Research Report,* R-41, Jan. 1959, 15 pp. (TN26 C16.5r Contin.)

10939 Pelletizing Before Sintering: Some Experiments With a Disc. The installation of a disc pelletizer at the BISRA north-east coast laboratories has provided valuable data on the effect of prepelletizing upon the sintering characteristics of both home and foreign ore mixes. The results have shown that pellets below ¼ inch are to be avoided and that the fuel can be most profitably introduced to the sinter mix after pelletizing. ***F. D. Ball.*** *Iron and Steel Institute, Journal,* v. 192, pt. 1, May 1959, p. 40-55.

10940* On the Part Played by Heat Recuperation and Ignition in the Sintering Process. The portion of the recuperated heat for the average layer of the sintered charge consists of about 63% of the total heat of the process. The intensity of ignition must be determined by the amount of heat emitted by the burners on a sq. m. surface of the charge passing under the ignition furnace. In sintering non-fluxed ores, the same intensity consisted of $11.5 \cdot 10^3$ - $13.5 \cdot 10^3$ thermal units per sq. m. (*In Russian.*) O roli regeneratsii tepla i zazhiganiia v aglomeratsionnom protsesse. ***A. A. Sigov.*** *Izvestiia Vysshikh Uchebnykh Zavedenĭ, Chernaia Metallurgiia,* 1959, no. 2, Feb., p. 13-25.

10941 Designing Ore-Treatment Pilot Plants. ***Robert D. MacDonald and Frank M. Stephens, Jr.*** *Mining Engineering,* v. 11, May 1959, p. 509-512.

10942 Recent Developments in Pebble Milling. ***Bunting S. Crocker.*** *Mining Engineering,* v. 11, May 1959, p. 527-530.

10943* Ore-Dressing Notes. Gravity concentration; heated screens; ion exchange techniques. *Mining Magazine,* v. 100, no. 5, May 1959, p. 278-280.

10944 Process Chemistry. Recovery of U from ores; production of intermediates and feed materials; ion exchange processes and solvent extraction. ***F. R. Bruce, J. M. Fletcher, and H. H. Hyman, editors.*** v. II. 579 pp. 1958. Permagon Press, New York. (QC776 P94n)

10945* Blending of Iron Ores in Iron and Steel Works. About 70 to 85% of the blended ore analyzed exhibits a deflection of the average Fe content of ± 10%. Providing the plants with Fe ore raw material and improving the blending methods will permit variation in Fe content between ± 0.5 and ± 0.7%. (*In Russian.*) Usrednenie zheleznykh rud na metallurgicheskikh zavodakh. ***Kh. P. Zaitsev, I. A. Volokh, and Z. N. Vorogushina.*** *Stal',* v. 19, no. 5, May 1959, p. 385-389.

10946 Conversion of Nicaro Nickel Oxide to Nickel Metal. Determination of whether specification-grade nickel could be made from nickel oxide produced at Nicaro, Cuba, in pilot-plant scale operations involving direct reduction and melting processes; also a study to obtain cost data on the pilot-plant operation to estimate the cost of producing ingot nickel at an annual rate of 12 million pounds. ***W. M. Mahan, N. B. Melcher, J. P. Riott, and E. J. Ostrowski.*** U. S. *Bureau of Mines Report of Investigations* 5465, 1959, 36 pp. (TN21 Un3r Vis.)

See also: **10031** (foam fractionation metals).

PHYSICS

10947 The Molecular Structure of Liquids. The objective of this survey is clearly to describe the roles played by variation in density and temperature in the establishment of the detailed molecular structure of liquids. ***John S. Dahler.*** *A.I.Ch.E. Journal,* v. 5, no. 2, June 1959, p. 212-222.

10948 Theory of the A. F. Joffe Method for Rapid Measurement of the Thermal Conductivity of Solids. ***W. F. G. Swann.*** *Franklin Institute, Journal,* v. 267, no. 5, May 1959, p. 363-380.

10949* Magnetic Hysteresis and Domain Structure. A brief survey is made of some of the problems involved in development of experimental methods of obtaining information on the domain processes involved in low field magnetization of polycrystalline materials. ***R. S. Tebble.*** *Journal de Physique et le Radium,* v. 20, nos. 2-3, Feb.-Mar. 1959, p. 98-100.

10950* Micromagnetics: Successor to Domain Theory? In domain theory, the domain and wall concepts are treated as fundamental as soon as the thickness and energy of a wall have been calculated. The alternative considered here is a complete, self-consistent, three-dimensional calculation based on the continuous-magnetization concept, in which domains and walls are not postulated; when they are valid concepts, they must emerge automatically from the theory. The stable equilibrium states are solutions of a nonlinear boundary-value problem. This problem has been solved in the one-dimensional case of traditional domain theory, in linearizable cases of nearly uniform magnetization, and in special nonlinear cases amenable to a Ritz approximation or to numerical solution by high-speed computers. ***William Fuller Brown, Jr.*** *Journal de Physique et le Radium,* v. 20, nos. 2-3, Feb.-Mar. 1959, p. 101-104.

10951* Domain Configurations in Cubic Crystals of Positive Anisotropy With Superimposed Uniaxial Anisotropy. An analysis of domain configurations for a cubic crystal of positive anisotropy with superimposed uniaxial anisotropy is given. Various multi- and single-domain configurations are predicted as a function of magnitude and direction of applied field in terms of the magnetic parameters. Criteria for transitions betwen these configurations are given. The analysis is applied to magnetic data for magneto-thermally annealed single-crystal cobalt ferrite. Agreement with the proposed models is obtained. ***J. O. Artman and S. Foner.*** *Journal de Physique et le Radium,* v. 20, nos. 2-3, Feb.-Mar. 1959, p. 105-108.

10952* Some Recent Progress in the Theory of Magnetism for Non-Migratory Models. ***J. H. Van Vleck.*** *Journal de Physique et le Radium,* v. 20, nos. 2-3, Feb.-Mar. 1959, p. 124-135.

10953* Electron Interactions and Ferromagnetism in Metals. It is suggested that the effects of electron correlation in metallic ferromagnetics, which must be included in discussions based on the collective electron treatment, could be considered from the point of view of plasma theory, and that some features of the spin wave treatment are thereby introduced. ***D. M. Edwards and E. P. Wohlfarth.*** *Journal de Physique et le Radium,* v. 20, nos. 2-3, Feb.-Mar. 1959, p. 136-137.

10954* The Determination of the Hyperfine Coupling in Ferromagnetic Metals by Nuclear Orientation and Low Temperature Specific Heats. The hyperfine coupling in metallic Co and in Co alloys has been determined both by nuclear orientation and by low temperature specific heats. The results are discussed in the light of Marshall's theoretical predictions. Specific heat measurements in Tb metal indicate a hyperfine coupling which is about 6% smaller than that found for the Tb^{+++} ion in a paramagnetic salt. ***N. Kurti.*** *Journal de Physique et le Radium,* v. 20, nos. 2-3, Feb.-Mar. 1959, p. 141-144.

10955* The Anisotropy of Very Small Cobalt Particles. Torque and ferromagnetic resonance measurements on a single crystal of a Cu–2% Co alloy have been made at various temperatures to determine the magnetocrystalline anisotropy of small single domain particles of precipitated Co. The anisotropy at 4.2 K is found to be independent of particle radius from 21 Å to 77 Å, lending support to a crystal field model of the origin of anisotropy. A slight variation of anisotropy with particle size was observed at higher temperatures, and was related to a slight variation in saturation magnetization with particle size at these temperatures. ***C. P. Bean, J. D. Livingston, and D. S. Rodbell.*** *Journal de Physique et le Radium,* v. 20, nos. 2-3, Feb.-Mar. 1959, p. 298-302.

10956* Domain Patterns and Reversals by Wall Movements of Thin Films of Iron and Nickel Iron. The reversal of the direction of magnetization by domain wall movements has been studied on two thin evaporated ferromagnetic films (Fe and Ni-Fe) by the Bitter colloid technique. For each film the magnetization reversal was observed both parallel and perpendicular to the direction in which a magnetic field was

applied during evaporation. The behavior of the iron film is similar in both directions but in the case of the Ni-Fe film the reversal of magnetization in the perpendicular direction takes place mainly by rotation. ***C. E. Fuller.*** *Journal de Physique et le Radium*, v. 20, nos. 2-3, Feb.-Mar. 1959, p. 310-318.

10957* The Magnetic Susceptibility of an MnO Single Crystal. The magnetic susceptibility of an MnO single crystal grown by flame fusion was found to be similar to the powder material; however, the magnetic field dependence of the susceptibility was larger than the dependence for the powder and in addition extended into the paramagnetic region. ***T. R. McGuire and R. J. Happel, Jr.*** *Journal de Physique et le Radium*, v. 20, nos. 2-3, Feb.-Mar. 1959, p. 424-426.

10958* On the Motion of a Particle Coupled to Lattice Vibrations. The approach to equilibrium of a particle interacting with the vibrations of an equilibrium lattice is studied using the methods developed by Prigogine and co-workers. ***Thor A. Bak, M. Goche, and F. Henin.*** *Molecular Physics*, v. 2, no. 2, Apr. 1959, p. 181-189.

10959 Irreversible Processes in Gases. I. The Diagram Technique. II. The Equations of Evolution. I. ***Prigogine and R. Balescu.*** *Physica*, v. 25, Apr. 1959, p. 281-323.

10960 Stopping of Low-Energy H^+ and He^+ Ions in Plastics. The stopping cross sections of polystyrene, polyethylene, and Pliolite S-5A for 40- to 340-kev H^+ and He^+ ions have been measured. ***Donald C. Lorents and E. J. Zimmerman.*** *Physical Review*, v. 113, 2nd ser., no. 5, Mar. 1, 1959, p. 1199-1203.

10961 A Review of High-Temperature Rotating-Plasma Experiments. Four experimental approaches for containing and heating plasmas. ***John M. Wilcox.*** *U. S. Atomic Energy Commission, UCRL*-8584, Jan. 1959, 25 pp. (UF767 U3u Contin.)

See also: **9996** (oxide magnets).

PLASTICS

10962 Shear Effects in Glass Fiber Reinforced Plastics Laminates. Magnitude of apparent flexural strength appears to depend primarily upon the strength characteristics of the resin. ***R. E. Chambers and F. J. McGarry.*** *ASTM Bulletin*, no. 238, May 1959, p. 38-41.

10963* Synthesis of Graft Copolymers by Radiation Chemical Methods. One method consists in irradiating a polymer A_n in the presence of a monomer *B*. The macromolecular free radicals *Ap* thus created by the radiolysis directly initiate the polymerization of monomer *B* leading to the formation of graft copolymer *ApBq*. According to the second method, macromolecular peroxides are prepared by irradiating polymer A_m in the presence of oxygen and are used to initiate the polymerization of monomer *B*. (*In French.*) Synthèse des copolymères par voie radiochimique. ***A. Chapiro.*** *Acta Chimica Academiae Scientiarum Hungaricae*, v. 18, nos. 1-4, 1959, p. 5-15.

10964* Polymerization at Low Temperatures. Unsaturated organic compounds as vinyl, acrylic, methacrylic, and styrene compounds can be polymerized with different methods by using redox systems. The author dealt with the peroxide system: tertiary amine: organic S compound in detail, in order to make the preparation of defectless, colorless polymerizates at low temperature possible, mainly in the field of methacrylates, and at the same time to obtain certain information as regards the mechanism of reaction. (*In German.*) Polymerisation bei niederen Temperaturen. ***W. Strubell.*** *Acta Chimica Academiae Scientiarum Hungaricae*, v. 18, nos. 1-4, 1959, p. 467-477.

10965* Synthesis of Polyvinyl Pyrrolidone and of Its Analogues. New synthesis for polyvinyl pyrrolidone, starting from furfural. ***R. Bácskai.*** *Acta Chimica Academiae Scientiarum Hungaricae*, v. 19, no. 1, 1959, p. 1-12.

10966 Copolymerization Characteristics of Two Vinylsilanes. The copolymerization characteristics of vinyltriethoxysilane and vinyltrimethylsilane are summarized. ***Charles E. Scott and Charles C. Price.*** *American Chemical Society, Journal*, v. 81, June 5, 1959, p. 2670-2672.

10967 Irradiation of Polyethylene. III. Influence of Temperature and Phase. γ-Ray irradiation of the linear polyethylene, Marlex-50, above the melting point yields a higher evolution of H, a greater degree of crosslinking, and of vinylene double bond production, than irradiation at room temperature. ***T. F. Williams and Malcolm Dole.*** *American Chemical Society, Journal*, v. 81, June 20, 1959, p. 2919-2926.

10968* The Effect of Heat and Water Immersion on the Flexural Strength of Certain Glass Fibre/Polyester Resin Laminates. II. ***H. J. Brookfield and D. Pickthall.*** *Applied Plastics*, v. 2, May 1959, p. 41-44.

10969 A New Type of Secondary Plasticiser for Polyvinyl Chloride. Polyalkylated benzenes such as Somil are compared with other types of secondary plasticizers. ***E. W. J. Beaven and D. Liff.*** *British Plastics*, v. 32, May 1959, p. 197-198.

10970 Chemistry and Properties of Polypropylene. Process and product studies on polypropylene show that a new class of polymer with a very interesting combination of properties is becoming available. ***J. M. Goppel.*** *British Plastics*, v. 32, May 1959, p. 207-212.

10971* Permeability of Amylose Film to Moisture Vapor, Selected Organic Vapors, and the Common Gases. ***J. C. Rankin, I. A. Wolff, H. A. Davis, and C. E. Rist.*** Paper from "Chemical & Engineering Data Series", v. 3, no. 1, p. 120-123, Apr. 1958. American Chemical Society, Washington, D. C. (QD501 In3c Ref.)

10972* Viscosity-Concentration Relations of Cellulose Acetate. Relationship of concentrated solution viscosities of secondary cellulose acetate over a wide range of both concentration and intrinsic viscosity. ***J. A. Mitchell and J. C. Umberger.*** Paper from "Chemical & Engineering Data Series", v. 3, no. 1, p. 124-128, Apr. 1958. American Chemical Society, Washington, D. C. (QD501 In3c Ref.)

10973* Weathering of Poly(vinyl Chloride) Effect of Composition. Effects of weathering on various resins, plasticizers, and light absorbers. ***J. B. Decoste, J. B. Howard, and V. T. Wallder.*** Paper from "Chemical & Engineering Data Series", v. 3, no. 1, p. 131-140, Apr. 1958. American Chemical Society, Washington, D. C. (QD501 In3c Ref.)

10974* Properties of Flexible Urethane Foams. ***J. H. Saunders, et al.*** Paper from "Chemical & Engineering Data Series", v. 3, no. 1, p. 153-161, Apr. 1958. American Chemical Society, Washington, D. C. (QD501 In3c Ref.)

10975* Some Correlations Between Mechanical Properties and Structure of Epoxy Resin Castings. From hundreds of epoxy resin-hardener systems tested, some generalizations about the influence of chemical architecture on physical properties have been drawn. ***John Wynstra.*** Paper from "Chemical & Engineering Data Series", v. 3, no. 2, p. 294-296, Oct. 1958. American Chemical Society, Washington, D. C. (QD501 In3c Ref.)

10976* Long-Chain Phosphorus Compounds as Low Temperature Plasticizers for Vinyl Chloride Polymers. ***Daniel Swern, W. E. Palm, Bernard Ackerman, and Lee P. Witnauer.*** Paper from "Chemical and Engineering Data Series", v. 3, no. 2, p. 346-349, Oct. 1958. American Chemical Society, Washington, D. C. (QD501 In3c Ref.)

10977 Plastics Take Ultra-High Temperatures. Latest developments in the new field of plastics which stand up to temperatures above 1000 F, where most metals and ceramics fear to tread. ***I. J. Gruntfest.*** *Chemical Engineering*, v. 66, June 1, 1959, p. 134 + 2 pages.

10978 Polymerisation of Epoxides. I. Some Kinetic Aspects of the Addition of Alcohols to Epoxides Catalysed by Sodium Alkoxides. II. The Polymerisation of Ethylene Oxide by Sodium Alkoxides. I. ***Geoffrey Gee, W. C. E.***

Higginson, P. Levesley, and K. J. Taylor. II. ***Geoffrey Gee, W. C. E. Higginson, and G. T. Merrall.*** *Chemical Society, Journal*, 1959, Apr., p. 1338-1352.

10979* Stereospecific Polymerizations of Conjugated Diolefins. III. Polymerization of Butadiene With the Al $(C_2H_5)_3$-$TiCl_4$ System. (*In Italian.*) Polimerizzazioni stereospecifiche di diolefine coniugate. III. Polimerizzazione del butadiene con il sistema $Al(C_2H_5)_3$-$TiCl_4$. ***G. Natta, L. Porri, A. Mazzei, and D. Morero.*** *Chimica e l'Industria*, v. 41, May 1959, p. 398-404.

10980* On the Kinetics of the Homogeneous Solution Polymerization of Acrylonitrile. I. Termination Reaction. Kinetics of polymerization of acrylonitrile, initiated by azoisobutyronitrile, benzoyl peroxide, and ammonium persulfate in ethylene carbonate, butyrolactone, and dimethylformamide. (*In German.*) Zur Kinetik der homogenen Lösungspolymerisation von Acrylnitril. I. Abbruchreaktion. ***Joachim Ulbricht.*** *Faserforschung und Textiltechnik*, v. 10, Mar. 1959, p. 115-120.

10981 Effect of Retarders and Promoters on Polymerization of Alpha-Methylstyrene. Polypropylene glycol ether and polyethylene oxide were found to be good promoters in the polymerization of α-methylstyrene. ***Giffin D. Jones and Ralph E. Friedrich.*** *Industrial and Engineering Chemistry*, v. 51, June 1959, p. 745-748.

10982 Flow Properties of Linear Polymers. Flow viscosity of a polymer is an important parameter when fabrication and processing performance of a polymer are to be correlated. ***H. J. Karam.*** *Industrial and Engineering Chemistry*, v. 51, July 1959, p. 851-853.

10983 Extruding Teflon Resin for Flexible Tubing and Wire Insulation. *Insulation*, v. 5, June 1959, p. 12-14.

10984* Dynamical Properties of the New "Rubber-like" Irradiated Polyethylene. Polyethylene grade 20 irradiated with different doses from 0 to 149 units of radiation. Dynamic properties measured in a frequency range extending from 0.0005 cycles/sec. to 50 kilocycles/sec. and in a temperature range from −50 to 100 C. ***A. A. Rady.*** *Journal of Applied Polymer Science*, v. 1, no. 2, Mar.-Apr. 1959, p. 129-132.

10985* Physical Properties of High Molecular Weight Acetal Resins. Information is presented on those physical properties where measurement is greatly facilitated by thermal stability greater than previously known in polyoxymethylenes, and properties of a mechanical nature characteristic of high molecular weight polymeric materials. ***W. H. Linton and H. H. Goodman.*** *Journal of Applied Polymer Science*, v. 1, no. 2, Mar.-Apr. 1959, p. 179-184.

10986* The Kinetics of the Thermal Degradation of the Synthetic Styrenated Polyester, Laminac 4116. Kinetics investigated in air and Ar at atmospheric pressure by means of a continuous recording thermobalance and by differential thermal analysis. ***David A. Anderson and Eli S. Freeman.*** *Journal of Applied Polymer Science*, v. 1, no. 2, Mar.-Apr. 1959, p. 192-199.

10987* Polymers From the Unsaturated Bisacetals of Pentaerythritol. ***Frank Brown, Donald E. Hudgin, and Raymond J. Kray.*** *Journal of Chemical and Engineering Data*, v. 4, no. 2, Apr. 1959, p. 182-187.

10988 Polymers. II. Polydimethyleneacetylene. Condensation of 1-chloro-4-bromo-2-butyne with Mg produced a mixture of soluble and insoluble polymers. ***William J. Bailey and Edward J. Fujiwara.*** *Journal of Organic Chemistry*, v. 24, Apr. 1959, p. 545-548.

10989 The Kinetics of the Polymerization of Ethylene With Triethylaluminum and Titanium Tetrachloride Catalysts. Polymerization of ethylene was carried out in a heptane solution at 37 C. ***Hans Feilchenfeld and Moshe Jeselson.*** *Journal of Physical Chemistry* v. 63, May 1959, p. 720-722.

10990 Irradiation of Polyethylene. IV. Oxidation Effects. Radiolytic oxidation studied by measuring changes in total pressure, by observing increases in optical density in the infrared due to carbonyl absorbance and by analyzing gaseous products of oxidation when polyethylene film of different thicknesses was exposed to γ-radiation in the initial presence of a few cm. pressure of oxygen. ***Hiroshi Matsuo and Malcolm Dole.*** *Journal of Physical Chemistry*, v. 63, June 1959, p. 837-843.

10991* Moisture Permeability of Polymers. I. Role of Crystallinity and Orientation. Quantitative relations of crystallinity to moisture permeability of polyethylene terephthalate, nylon 610, and several polyethylenes are presented. ***S. W. Lasoski, Jr. and W. H. Cobbs, Jr.*** *Journal of Polymer Science*, v. 36, Apr. 1959, p. 21-33.

10992* Radiochemical Studies of Free-Radical Vinyl Polymerizations. I. The Nature of the Initiation and Termination Processes in Methyl Methacrylate and Styrene Polymerizations Using C^{14}-Labeled Initiators. II. The Polymerization of Vinyl Monomers in the Presence of Polyisoprenes: Use of C^{14}-Labeled Initiators to Determine the Mechanism of Graft-Interpolymer Formation. I. ***G. Ayrey and C. G. Moore.*** II. ***P. W. Allen, G. Ayrey, and C. G. Moore.*** *Journal of Polymer Science*, v. 36, Apr. 1959, p. 41-76.

10993* Study of Particles Present in Some High-Pressure Polyethylenes. Scattering of light by solutions of high-pressure polyethylenes reveals that very large particles are present. Data are presented in conjunction with electron micrographs which support the conclusion that the intensely scattering particles are actually molecules of polyethylene. ***Louis D. Moore, Jr. and Virgil G. Peck.*** *Journal of Polymer Science*, v. 36, Apr. 1959, p. 141-153.

10994* The Copolymerization of Silicon-Substituted Styrenes. ***Charles W. Lewis and Daniel W. Lewis.*** *Journal of Polymer Science*, v. 36, Apr. 1959, p. 325-328.

10995* Infrared Spectra of Vinylidene Chloride-Vinyl Chloride Copolymer. Studies of the changes produced in the infrared spectra of copolymers when vinyl chloride content is varied. ***S. Narita, S. Ichinohe, and S. Enomoto.*** *Journal of Polymer Science*, v. 36, Apr. 1959, p. 389-405.

10996* Nitrocarboxymethyl Cellulose. Preparation and evaluation. ***Howard C. Haas and Norman W. Schuler.*** *Journal of Polymer Science*, v. 36, Apr. 1959, p. 447-452.

10997* Kinetics of the Gamma-Induced Graft Copolymerization of Vinyl Acetate to Teflon. Effect of intensity, temperature, monomer concentration and other parameters on the rate of grafting. ***A. J. Restaino and W. N. Reed.*** *Journal of Polymer Science*, v. 36, Apr. 1959, p. 499-510.

10998* Electron-Microscopic Examination of Polytetrafluorethylene. ***G. Schimmel.*** *Journal of Polymer Science*, v. 36, Apr. 1959, p. 552-553.

10999* Initiation of Polymerization With Irradiated Crystals. The system *N-tert*-butylacrylamide-styrene was studied. ***George Adler and Peter Colombo.*** *Journal of Polymer Science*, v. 37, May 1959, p. 309-310.

11000* Metallic Soaps as Initiators of Vinyl Polymerization-Polymerization of Methyl Methacrylate Using Ferric Laurate as Catalyst. A tentative mechanism, basically of the free radical type, has been suggested. ***V. Linganmurty and Santi R. Palit.*** *Journal of Scientific & Industrial Research*, v. 18B, Apr. 1959, p. 140-144.

11001* Effect of Small Plasticizer Concentrations on PVC. Embrittlement effects in polyvinyl chloride and vinyl chloride copolymers when small amounts of plasticizer are added. (*In German.*) Wirkung kleiner Weichmacher-Konzentrationen in Vinylchlorid-Polymerisaten. ***O. Fuchs and H. H. Frey.*** *Kunststoffe*, v. 49, May 1959, p. 213-216.

11002* The Measurement of Dimensional Stability at Elevated Temperatures. Significance of "Martens Number", "Vicat Number", or similar values. A simple explanation for the fact that the Martens test, which has proved so effective for thermosets, has failed for thermoplastics. An effective and simple method of dealing with this problem. (*In German.*) Zur Messung der "Formbeständigkeit in der Wärme". ***W. Gohl.*** *Kunststoffe*, v. 49, May 1959, p. 228-229.

11003* Polymerization and Copolymerization of Vinyl Benzoate. ***A. Vrancken and G. Smets.*** *Makromolekulare Chemie*, v. 30, nos. 2/3, May 1959, p. 197-211.

11004* Studies on Polymerization and Depolymerization of ε-Caprolactam Polymer VII. On the Amide Interchange Reaction. ***Naoya Ogata.*** *Makromolekulare Chemie*, v. 30, nos. 2/3, May 1959, p. 212-224.

11005* Structure and Reactivity of Vinyl Aromatic Monomers in Coordinated Anionic Polymerisation and Copolymerisation. Relative reactivities of vinyl aromatic monomers in stereospecific polymerization and copolymerization. ***Giulio Natta, Ferdinando Danusso, and Dario Sianesi.*** *Makromolekulare Chemie*, v. 30, nos. 2/3, May 1959, p. 238-246.

11006 Vinyl Plasticizer Developments. A review of plasticizer types, properties, and formulating techniques. ***Richard G. Kadesch.*** *Modern Plastics*, v. 36, no. 9, May 1959, p. 133 + 15 pages.

11007 Blow Molding Polyethylene. II. How quality factors—glass, roughness, welding at seal, and wall uniformity—are affected by processing variables. ***R. L. Wechsler and T. H. Baylis.*** *Modern Plastics*, v. 36, no. 10, June 1959, p. 115 + 5 pages.

11008 Isophthalic Polyesters. Preparation, properties, applications. Advantages in glass reinforced laminates and moldings. ***Earl E. Parker.*** *Modern Plastics*, v. 36, no. 10, June 1959, p. 135 + 3 pages.

11009* Studies on the Ageing of Plastics. II. Efficiency of Plasticizers During the Exposure of Plastics to Light and Weathering. IV. The Alteration of Polymer Distribution During the Ageing of Nitro-Cellulose. V. The Alteration of Polymer Distribution During the Ageing of Benzylic Cellulose. (*In German.*) Studien zur Alterung von Plasten. II. Die Wirksamkeit der Weichmacher die ber Belichtung und Bewitterung von Plasten. ***K. Thinius and J. Schreiber.*** IV. Die Veränderung der Polymerverteilung bei der Alterung von Nitrozellulose. V. Die Veränderung der Polymerverteilung bei der Alterung von Benzylzellulose. ***K. Thinius, J. Schreiber, and R. Berger.*** *Plaste und Kautschuk*, v. 6, Apr. 1959, p. 169-183.

11010 Properties, Processing and Uses of Hostalen Polythene. Analysis of techniques for processing the Hostalen grades of high density polythene. ***Hans Domininghaus.*** *Plastics, (London)*, v. 4, May 1959, p. 164-168.

11011* Embrittlement of Polyethylenes. Tests show that embrittlement is a result of an increase in polymer crystallinity and polymer oxidative degradation. ***C. S. Imig.*** *Plastics Technology*, v. 5, May 1959, p. 35 + 3 pages.

11012* Molding of Diallyl Phthalate Compounds. Characteristics affecting the molding of filled compounds are described, together with molding defects and their elimination. ***L. B. Keller, W. R. McGlone, and D. H. Woodin.*** *Plastics Technology*, v. 5, May 1959, p. 38 + 5 pages.

11013* Vinyl Stabilization. Some New Materials and Techniques. Types of organotin stabilizers. Comparative evaluations are presented on both weight and cost basis. ***H. Verity Smith.*** *Rubber Journal and International Plastics*, v. 136, no. 18, May 2, 1959, p. 655 + 3 pages.

11014* Vulkene, Chemically Cross-Linked Polyethylene. Story of the development of a polyethylene cross-linked chemically, using organic peroxides. Under the name Vulkene, it is being used for a line of service drop cables and aerial secondary service. ***A. R. Lee and J. E. Vostovich.*** *Rubber World*, v. 140, no. 3, June 1959, p. 429-434.

11015* On the Relationship of Physical Properties to Structure in Linear Polymers of Ethylene and Propylene. ***Laurits T. Muus, N. Gerard McCrum, and Frank C. McGrew.*** *SPE Journal*, v. 15, May 1959, p. 368-372.

11016* Progress in Five Years of Research in Stereospecific Polymerization. ***Giulio Natta.*** *SPE Journal*, v. 15, May 1959, p. 373-382.

11017* A Review of Stress-Cracking in Polyethylene. ***John B. Howard.*** *SPE Journal*, v. 15, May 1959, p. 397-412.

11018 Sorbitol Polyethers in Rigid Urethane Foam. Preparation of polyethers and foams. ***Joseph E. Wilson.*** *Modern Plastics*, v. 36, no. 9, May 1959, p. 151 + 1 page.

See also: **10096** (silicone polymers); **10270** (acrylonitrile polymerization); **10611** (viscosity of high polymer solutions); **10960** (stopping cross sections of plastics).

POLLUTION AND WASTES

11019 Air Pollution Measurements of the National Air Sampling Network. Analyses of Suspended Particulates. Much of this report consists of the tables which present this information. 259 pp. 1958. U. S. Department of Health, Education, and Welfare, Washington, D. C. (TD883 Rs4a Over.)

11020 Instruments for the Study of Atmospheric Pollution. The third revised edition with an outline list of instruments and an alphabetical reference list. 3rd Ed. 23 pp. 1959. The American Society of Mechanical Engineers, New York. (TD883 Am35i3 Over.)

11021 Simplified Air-Sampling Method. A fast, accurate, and simple air sampler for particulate contaminants is provided by electrostatically precipatating the particulates on the sampler-tube wall, converting the tube to an ionization chamber, fitting it to an electrometer and recording the current with a strip-chart recorder. ***Robert D. Thomas.*** *Nucleonics*, v. 17, May 1959, p. 134 + 1 page.

11022* Response of Fish to Sub-Lethal Exposures of Organic Phosphorus Insecticides. ***Charles M. Weiss.*** *Sewage and Industrial Wastes*, v. 31, May 1959, p. 580-593.

See also: **10065** (dewatering of paper mill sludges); **10080** (treatment of effluent from strip pickling lines).

RUBBER AND ELASTOMERS

11023* Polymerization of Some 1-Alkyl-1-hydroperfluoroalkyl Acrylates. ***L. E. Coleman, Jr., D. A. Rausch, and W. R. Griffin.*** Paper from "Chemical & Engineering Data Series", v. 3, no. 1, p. 113-115, Apr. 1958. American Chemical Society, Washington, D. C. (QD501 In3c Ref.)

11024* Properties of Hycar 1072—a Carboxylic Nitrile Rubber. Reactions and properties that have been demonstrated by Hycar 1072. ***C. H. Lufter and N. G. Duke.*** Paper from "Chemical & Engineering Data Series", v. 3, no. 2, p. 297-304, Oct. 1958. American Chemical Society, Washington, D. C. (QD501 In3c Ref.)

11025 Safe Processing Curing Systems for Viton Fluoroelastomers. Use of blocked diamine curing agents, alone and in combination with diamine retarder-activator, permits development of safe processing Viton fluoroelastomer compounds. ***A. L. Moran, R. P. Kane, and J. F. Smith.*** *Industrial and Engineering Chemistry*, v. 51, July 1959, p. 831-832.

11026* The Dynamic Mechanical Properties of Hypalon-20 Synthetic Rubber at Small Strains. ***S. F. Kurath, E. Passaglia, and R. Pariser.*** *Journal of Applied Polymer Science*, v. 1, no. 2, Mar.-Apr. 1959, p. 150-157.

11027* Redox Recipes. X. A Recipe With Ferric Versenate, Sodium Dithionite, and Hydroperoxide as Activating System (Veroxathionite Recipe). ***I. M. Kolthoff and E. J. Meehan.*** *Journal of Applied Polymer Science*, v. 1, no. 2, Mar.-Apr. 1959, p. 200-201.

11028* *cis-trans* Isomerization in Polyisoprenes. I. Improvement of the Low Temperature Properties of Natural Rubber by Reaction With Thiol Acids in Solutions and in

Latex. ***J. I. Cunneen and F. W. Shipley.*** *Journal of Polymer Science*, v. 36, Apr. 1959, p. 77-90.

11029* *cis-trans* Isomerization of Polyisoprene. *cis-trans* Isomerization of polyisoprene in solution catalyzed by elemental Se at temperatures of around 180-200 C. ***M. A. Golub.*** *Journal of Polymer Science*, v. 36, Apr. 1959, p. 523-524.

11030* Vulcanization of High-Elastic Polymers. XXV. Vulcanization of Natural and Synthetic Rubbers With Sulfur in the Presence of Sulfenamides. I. Vulcanization of Perbunan N 2818 with S in the presence of N-cyclohexylbenzothiazolylsulfenamide at different temperatures and under the condition of varying concentration of accelerator and S. (*In German.*) Zur Kenntnis der Vulkanisation hochelastischer Polymerisate. XXV. Die Vulkanisation von Naturkautschuk und synthetischen Kautschuken durch Schwefel in Anwesenheit von Sulfenamiden. I. ***Walter Scheele, Horst-Eckart Toussaint, and Yuan-Kun Chai.*** *Kautschuk und Gummi*, v. 12, May 1959, p. 122WT-128WT.

11031* Dynamic Behavior of Tires. Dynamic properties characterizing a pneumatic tire and the relations consisting between them and the effective forces and motions. (*In German.*) Zur Dynamik des Luftreifens. ***W. Hofferberth.*** *Kautschuk und Gummi*, v. 12, May 1959, p. 134WT-140WT.

11032 Highly Fluorinated Rubber May Compete With Viton. New fluorinated elastomer called Fluorel is a fully saturated fluorinated polymer containing more than 60% fluorine by weight. *Materials in Design Engineering*, v. 49, May 1959, p. 152 + 4 pages.

11033 Blow Molding Polyethylene. I. A quantitative report on how processing and material-selection factors in extrusion/blow-molding influence wall thickness, crystallinity, permeability, and minimum cooling time of polyethylene bottles. ***R. L. Wechsler and T. H. Baylis.*** *Modern Plastics*, v. 36, no. 9, May 1959, p. 107 + 5 pages.

11034* Oil-Extended Rubbers and Their Significance for the Rubber Industry. (*In German.*) Die Bedeutung plastisch eingestellter Synthesekautschuke für die Gummiindustrie. ***H. Luttropp.*** *Plaste und Kautschuk*, v. 6, Apr. 1959, p. 155-168.

11035* Action of Iron on the Heat Aging of Vulcanized Rubber. Various mineral and organic Fe salts have been added to vulcanizates with different contents. A highly noxious action of Fe was noted, especially in sulfurless tetramethyl-thiuram-disufide compounds. With MBT compounds, however, the noxious action of Fe is much less important. Iron stearate and iron octoate are the most deleterious salts in all cases. (*In French.*) L'action du fer sur le vieillissement a la chaleur du caoutchouc vulcanisé. ***Patrick Fauvarque.*** *Revue Générale du Caoutchouc*, v. 36, Apr. 1959, p. 525-528.

11036* Effects of Gamma Radiation on Compression Set of Rubbers. How different elastomers are affected by various dosages of radiation. ***R. E. Morris, R. R. James, and F. Caggegi.*** *Rubber Age*, v. 85, no. 2, May 1959, p. 243-252.

11037 'Fluorel' High Temperature Rubber. "Fluorel" brand elastomer is a new high temperature, highly fluorinated synthetic rubber developed for long service under severe temperature and corrosion conditions. *Rubber and Plastics Age*, v. 40, May 1959, p. 428-430.

11038* The Reactions of Isocyanates and Isocyanate Derivatives at Elevated Temperatures. This review attempts to present the most essential reactions which may be expected of three commercially significant structural groups, isocyanate, urea, and urethane, at temperatures in the approximate range of 100-300 C. ***J. H. Saunders.*** *Rubber Chemistry and Technology*, v. 32, no. 2, Apr.-June, 1959, p. 337-345.

11039* The Influence of Intermolecular Action on the Dynamic Fatigue of Rubbers. Determination of the physical effect of softeners by an investigation of their influence on swelling of vulcanizates is a convenient method for investigating the optimum composition of a compound which will produce given properties in the cured stock. ***V. E. Gul, D. L. Fedyukin, and B. A. Dogadkin.*** *Rubber Chemistry and Technology*, v. 32, no. 2, Apr.-June 1959, p. 454-462. (Translated from *Kauchuk i Rezina*, v. 17, no. 9, 1958, p. 16-20.)

11040* Influence of Surface Condition, Duration of Molding, Pressure and Temperature Upon Bond Strength Between Components of Tire Casings. ***V. A. Pinegin, S. A. Vasil'eva, and L. M. Kepersha.*** *Rubber Chemistry and Technology*, v. 32, no. 2, Apr.-June 1959, p. 503-512. (Translated from *'Prochnost' Svyazi . . . .'* 1954, p. 87-97.)

11041* Enhancement of Bond Strength in Tire Casings by Heat Treatment. ***Kh. E. Malkina and A. P. Pukhov.*** *Rubber Chemistry and Technology*, v. 32, no. 2, Apr.-June 1959, p. 513-518. (Translated from *'Prochnost' Svyazi . . .'*, 1954, p. 158-163.)

11042* Vulcanizates From Natural Rubber and Bis-Azo Compounds. Aging Properties. Nonblack as well as black loaded natural rubber compounds were vulcanized by addition of hexamethylene-1,6-bis(phenyl-azomonocarbonamide). ***Heinz Esser.*** *Rubber Chemistry and Technology*, v. 32, no. 2, Apr.-June 1959, p. 544-556. (Translated from *Kautschuk und Gummi*, v. 11, 1958, p. WT57-WT62.)

11043* The Photovulcanization of Butyl and SKB (Polybutadiene) Rubbers. Optimum peak of photovulcanization in butyl rubber is explainable by an increasing dominance of the degradation processes involving the scission of the sulfur structures formed, as the irradiation is prolonged. ***Yu. S. Zuev.*** *Rubber Chemistry and Technology*, v. 32, no. 2, Apr.-June 1959, p. 557-561. (Translated from *Akademiia Nauk SSSR, Doklady*, v. 110, no. 1, 1956, p. 101-104.)

11044* Vulcanization of Elastomers. XXI. Vulcanization of Natural Rubber With Thiuram Disulfides. VI. ***Walter Scheele and Klaus Hummel.*** *Rubber Chemistry and Technology*, v. 32, no. 2, Apr.-June 1959, p. 566-576. (Translated from *Kautschuk und Gummi*, v. 11, Oct. 1958, WT267-WT272.)

11045* Infrared Spectra of Cured and Uncured Rubbers. ***G. A. Blokh and A. F. Mal'ner.*** *Rubber Chemistry and Technology*, v. 32, no. 2, Apr.-June 1959, p. 628-638. (Translated from *Legkaia Promyshlennost'*, no. 4, 1956, p. 38-44.)

11046* Radial Compression. The Effect of Low Temperatures on Rubber Packing Rings. Cooling of rubber seals brings about a decrease in radial force, the amount depending upon the initial compression. ***P. G. Morgan.*** *Rubber Journal and International Plastics*, v. 136, no. 22, May 30, 1959, p. 820.

11047* Ethylene-Propylene Copolymer Rubber. Data given indicates that C 23, a new synthetic elastomer, exhibits exceptional resistance to oxidation, ageing, and heat. Wear properties are also outstanding. *Rubber Journal and International Plastics*, v. 136, no. 23, June 6, 1959, p. 872.

11048* Accelerated Testing of Ozone Cracking Inhibitors. Relations among the accelerated ozone box tests, outdoor static and dynamic tests, viscosity degradation tests, and actual tire performance are surveyed. Emphasis is placed on providing a practical level of ozone cracking resistance. ***F. B. Smith and W. F. Tuley.*** *Rubber World*, v. 140, no. 2, May 1959, p. 243-251.

11049* Dithiol Curing Agents for "Viton" A Fluoroelastomer. This curing system provides compounds with good scorch resistance, high tensile strength, and low compression set, but at some loss of resistance to aging at temperatures of 550 F, when compared with the conventional hexamethylene diamine carbamate cure. ***J. F. Smith.*** *Rubber World*, v. 140, no. 2, May 1959, p. 263-266.

11050* Available Dry Styrene-Butadiene Rubbers (SBR) —United States and Canada. ***R. G. Seaman and C. A. Carlton.*** *Rubber World*, v. 140, no. 3, June 1959, p. 421-428.

See also: **10058** (rubbers in chemical plant); **10620** (friction of lubricated rubber).

SPACE HEATING AND CONDITIONING

11051 Dynamics of Fresh Air. Just what is fresh air? Author Beckett views it as a matter of electrical dynamics. ***John C. Beckett.*** *ASHRAE Journal*, v. 1, May 1959, p. 47-51.

11052 Predicting Annual Heating Costs of Residential Heat Pumps. ***Stanley F. Gilman and William Clausen.*** *ASHRAE Journal,* v. 1, May 1959, p. 52-55 + 5 pages.

11053 Small Gas Turbine Machines for Mobile Air Conditioning. Recent turbomachine design applications as key components of aircraft, ship, submarine, railroad, and automotive air-conditioning and refrigeration systems. ***Hans K. Ziebarth.*** *ASHRAE Journal,* v. 1, May 1959, p. 62-66.

11054 Performance of Water Source Heat Pumps in Pacific Northwest. ***J. Donald Kroeker.*** *ASHRAE Journal,* v. 1, May 1959, p. 78 + 4 pages.

11055 Convective Films Evaluated for Wire and Tube Heat Exchangers. ***O. W. Witzell, W. E. Fontaine, and W. J. Papanek.*** *ASHRAE Journal,* v. 1, June 1959, p. 35-37.

11056 Performance of an Air Source Compound Heat Pump. Recently, compound or multi-stage compression machines have been adapted to operate at reduced compression ratios, with increased output, and higher performance efficiencies. With these, auxiliary resistance heaters are not necessary. These developments prompted an investigation of the heat pump as a suitable means of heating and cooling a specific Philadelphia office building. ***A. D. Spillman.*** *ASHRAE Journal,* v. 1, June 1959, p. 38-41.

11057 Determination of the Effectiveness of Window Shading Materials on the Reduction of Solar Radiation Heat Gain. ***Richard C. Jordan and James L. Threlkeld.*** *ASHRAE Journal,* v. 1, June 1959, p. 45 + 5 pages.

11058* Air Conditioning Raises Output, Yields Other Advantages to Office Workers, Government Reports. Air conditioning increases work output nearly 10%, improves employee morale, decreases absenteeism, and has other advantages to employers and employees, according to carefully conducted tests by General Services Administration. *Air Conditioning, Heating and Ventilating,* v. 56, June 1959, p. 67-69.

11059* How Ventilation Costs Are Cut in Radioactive Areas. Methods employed in originating cost improvements applicable to the design of new, and the improvement of existing, ventilation systems at the Knolls Atomic Power Laboratory. ***T. T. Porembski.*** *Air Conditioning, Heating and Ventilating,* v. 56, June 1959, p. 73-77.

11060* Time-Saving Procedure for Piping Stress Analysis. Modern piping systems, connecting pumps, boilers, heat exchangers, and other equipment are installed at ambient temperatures, but often operate at temperatures up to 1,000 F. Thermal expansions of the systems create very large forces and stresses, which, if not provided for, will result in distortion of equipment and overstressing of piping. The procedure presented here is for efficient and time-saving analysis, and is based on the 1955 American Standard Code for Pressure Piping. ***K. Hao Hsiao.*** *Air Conditioning, Heating and Ventilating,* v. 56, June 1959, p. 81-96.

11061 Sizing of Steam Heating Equipment Needs Further Study. Discusses advantages of re-evaluating some well-established engineering principles. One example is operation of steam heating systems at higher pressures for resulting economies in space and installed costs. ***Lewis Smith.*** *Air Conditioning, Heating and Ventilating,* v. 56, June 1959, p. 103 + 1 page.

11062* Service Building Is Heated and Cooled Electrically. Plan provides operating cost comparison with two conventionally heated service buildings. ***L. H. Ruhlen and G. W. McElhaney.*** *Electrical World,* v. 151, June 15, 1959, p. 46-47.

11063* Air Conditioning Used in Plant's Architecture. Gas air conditioning permitted a simple, almost windowless design for Rockwell Mfg. Co.'s new plant at Porterville, Calif. Soldering furnace flues, attached to the building's outside wall, reduce the air conditioning load requirement. ***H. Campbell Stuckeman.*** *Heating & Air Conditioning Contractor,* v. 50, no. 8, May 1959, p. 60-63.

11064* Prefab Buildings Serve as Ducts in Factory Cooling Job. Prefabricated metal buildings were put to an unusual use in the Burlington, Iowa, plant of Sylvania Electric Co. They served as the main air distribution ducts for the building's 1200-ton air conditioning system. ***William McFee.*** *Heating & Air Conditioning Contractor,* v. 50, no. 8, May 1959, p. 70-71.

11065* How Electronic Air Cleaners "Pay for Themselves". Outlines a computation procedure which demonstrates that an investment in electronic air cleaners can be self-liquidating in installations, such as stores and offices, where cleaning costs are a factor. ***P. J. Zilles.*** *Heating & Air Conditioning Contractor,* v. 50, no. 9, June 1959, p. 67-69.

11066 Four Sets of Conditions Demand Unusual and Flexible System to Meet Variety of Temperature, Humidity, Dust Control Requirements in New Electronic-Mechanical Aircraft Components Plant. With four distinctly different sets of air conditioning and ventilation requirements, the building is divided into four areas by movable partitions. These areas may be increased or decreased at any time to accommodate some new production procedure requiring either more or less critical temperature, relative humidity, and dust control tolerances. ***Boris M. Lemos.*** *Heating, Piping & Air Conditioning,* v. 31, June 1959, p. 100-102.

11067 How to Design Freeze Protection for Makeup Supply Air Systems. The cold siege of the past winter has manifested freeze-up problems which require careful design consideration if they are to be solved. System inlets and dampers must be designed and located to afford uniform air flow. Face and bypass damper control, frequently used as a safeguard against freezing, is often inadequate if some inherent "bugs" are not ironed out. Air heaters must be chosen, arranged, and sized judiciously. ***John H. Clarke.*** *Heating, Piping & Air Conditioning,* v. 31, June 1959, p. 104-107.

11068 Temperature Drop Is an Important Design Yardstick in Choosing Most Economical Hot Water Heating System. ***C. F. Carlson.*** *Heating, Piping & Air Conditioning,* v. 31, June 1959, p. 116-119.

11069 Winning the Air Conditioning Odor Fight—Round 6. Blows From Outside the Arena. A common cause of store odor problems is the practice of locating packaged air conditioning units in or near odor sources and permitting the units to deliver this odor to the conditioned space. This situation can be corrected by sealing cabinet leaks and by insuring that enough outdoor air is being admitted. ***Albert B. Hubbard.*** *Heating, Piping & Air Conditioning,* v. 31, June 1959, p. 129-130.

11070 Evaluate Sensible, Latent Heat Gains for Close Temperature, Humidity Control. Close environmental control at Abbott Laboratories' experimental farm is essential for studying the effects of various feeds on poultry and swine. Because the sensible and latent heat outputs of these animals vary so widely under different conditions, a careful evaluation of design requirements was made by the author before deciding how close ventilation and temperature control would be achieved. ***F. F. Stevenson.*** *Heating, Piping & Air Conditioning,* v. 31, June 1959, p. 131-136.

11071* The Development of Air Conditioning in Ships. A short historical introduction is followed by a breakdown of the spaces in a ship from the point of view of air treatment. The practical problems of the air conditioning engineer are indicated, together with the associated problems of the naval architect and superintendent engineer. ***S. J. Jones and J. K. W. MacVicar.*** *Institute of Marine Engineers, Transactions,* v. 71, Apr. 1959, p. 101-124.

11072* Figure It Out Yourself—Will Air Conditioning Pay? Formula calculates at what point the increased worker efficiency will let air conditioning start to return a profit. *Paint, Oil & Chemical Review,* v. 122, May 28, 1959, p. 14-15.

11073* Solar Air Conditioning and Solar Refrigeration. Solar air conditioning without intermediary machines is explained, and ways are described for practical execution of solar air conditioning. Solar refrigeration without intermediary machinery is a continuation of solar air conditioning. Drops in temperature of 30 F and more are possible by it. Lower temperatures require employment of ventilators and heat exchangers. Their use provides temperatures of 33 to 35 F within a moving air current which is today's limit in solar refrigeration. For lower temperatures, rational resorption is reviewed in re-

gard to regeneration by collectors of solar heat. ***J. H. Dannies.*** *Solar Energy*, v. 3, no. 1, Jan. 1959, p. 34-39.

TEXTILES, FIBERS, LEATHER, AND PAPER

11074* Interspecific Incompatibility in Pinus. ***J. R. McWilliam.*** *American Journal of Botany*, v. 46, no. 6, June 1959, p. 425-433.

11075 A Microsporidian Parasite of the Forest Tent Caterpillar, *Malacosoma disstria HBN.* The life cycle of a microsporidian parasite of the forest tent caterpillar is described. The microsporidian attacks primarily the silk glands and the mid-gut epithelium but other tissues are also infected. ***H. M. Thomson.*** *Canadian Journal of Zoology*, v. 37, no. 3, June 1959, p. 217-221.

11076* Bark Utilization. Eight papers, reviewing means of using bark residues. Subjects include: making fertilizer–soil conditioner from bark as a trickling-filter media; commercial uses of redwood bark dust; chemicals from bark; bark in hardboard; milling redwood bark; recovery, preparation, and yields of redwood bark; and horticultural applications for bark and wood fragments. *Forest Products Journal*, v. 9, Apr. 1959, p. 19A-42A.

11077* Fungus Losses in the Paper Industry and Related Research Needs. Researches leading to control and prevention are suggested for pulpwood tree diseases and heartrot, pulpwood deterioration during storage, slime formation, and building decay problems. ***R. A. Zabel.*** *Tappi*, v. 42, May 1959, p. 28A + 3 pages.

11078* Carbon-14 Labeled Wood Cellulose. Wood cellulose tagged with C^{14} of sufficiently high activity to be easily counted can be prepared by simply injecting trees with small doses of aqueous solution of $Na_2C^{14}O_3$, or by exposing these trees to an atmosphere of $C^{14}O_2$ ***A. A. Selders, B. A. Staskiewicz, and Jean P. Picard.*** *Tappi*, v. 42, May 1959, p. 409-412.

11079* The Influence of High Energy Radiation on Cotton. I. The Properties of Raw Cotton Sliver Lap, Yarn, and Fabric Irradiated Under Various Conditions. II. Effects on Chemical Modification. ***Huo-Ping Pan, et al.*** *Textile Research Journal*, v. 29, May 1959, p. 415-425.

See also: **10040** (nylon-6 in tire manufacture); **10293** (foil and paper laminates); **10622** (friction of fibers, yarns, and fabrics).

WELDING AND JOINING

11080* Void-Free Bonds. Use of "ball-bonding" technique insures good pressure and heat distribution in fabricating B-52 honeycomb panels. Small Al balls (about ¼ in. diam.) are spread over the sandwich layup to be bonded, and pressure is brought to bear on the balls. ***R. F. Geiger.*** *Aircraft and Missiles Manufacturing*, v. 2, May 1959, p. 40-42.

11081 Zirconium Welds Join Parts for Atomic Power Plant. Properly controlled and sequenced fusion welding is key to successful fabrication. ***J. Glatter, E. G. Schwartz, W. L. Frankhouser, and J. H. Eyler.*** *American Machinist*, v. 103, May 18, 1959, p. 128-130.

11082* Tantalum Breaks Through, With New Production and Fabrication Techniques. Recent developments in welding have solved some of the major problems of fabrication of tantalum. ***Burton Payne.*** *American Machinist*, v. 103, June 1, 1959, p. 109-111.

11083 Welding and the Draughtsman. A design procedure is outlined for instances when welds are subjected to combinations of static and dynamic loading. ***H. B. Merriman.*** *British Welding Journal*, v. 6, June 1959, p. 255-265.

11084 Hot Cracking of Mild Steel Welds. Final Report on High-Temperature Tensile Tests. The results showed relatively low ductility in the range 950-1100 C, which was not appreciably affected by changes in the atmosphere. Similar results were obtained using rapid heating by high-frequency induction in an argon atmosphere. This minimum in ductility at about 1000 C showed a very poor correlation with the susceptibility to hot cracking of the weld metals as assessed by Murex hot-cracking tests. ***P. W. Jones.*** *British Welding Journal*, v. 6, June 1959, p. 269-281.

11085 An Investigation of Hot Cracking in Low-Alloy Steel Welds. The effects are shown of some alloying elements (C, Ni, Cu, Cr, and Al) which might be derived either from the electrode or from the alloy steel plate. The effects of preheating and weld size are also considered. ***P. W. Jones.*** *British Welding Journal*, v. 6, June 1959, p. 282-290.

11086 Interaction Between Slag and Metal in Electro-Slag Welding. Study of reactions involved in the transfer of Si and Mn from liquid slag to weld metal, as function of basicity of flux. ***Yu. N. Gotal'skii.*** *Henry Brutcher Translation No.* 4437, 11 pp. (From *Avtomaticheskaya Svarka*, v. 7, no. 5, 1954, p. 38-43.) Henry Brutcher, Altadena, Calif.

11087 Effect of Kind of Current on Interaction Between Slag and Metal in Electro-Slag Welding. Experimental verification of theory that there is electrolysis in electroslag welding. ***Iu. N. Gotal'skii.*** *Henry Brutcher Translation No.* 4438, 5 pp. (From *Avtomaticheskaya Svarka*, v. 8, no. 5, 1955, p. 47-49.) Henry Brutcher, Altadena, Calif.

11088 Electrical Characteristics of Generators for Carbon-Dioxide Shielded Welding. ***A. G. Mazel and K. K. Khrenov.*** *Henry Brutcher Translation No.* 4463, 12 pp. (From *Svarochnoe Proizvodstvo*, no. 8, Aug. 1957, p. 31-34.) Henry Brutcher, Altadena, Calif.

11089 Electrochemical Method of Determining Corrosion Resistance of Welds in Low-Alloy Steels. . . . by measuring the potential difference between weld metal and parent metal. ***N. D. Tomashov, M. A. Vedeneeva, and Z. I. Vasil'eva.*** *Henry Brutcher Translation No.* 4466, 8 pp. (From *Zavodskaya Laboratoriya*, v. 23, no. 6, 1957, p. 683-686.) Henry Brutcher, Altadena, Calif.

11090 Study of Effect of Vibrations on Solidification and Structure of Electro-Slag Weld Metal. Merits of vibrating weld puddles while they solidify. Authors' study of effect of industrial-frequency (25-50 cps) vibrational treatment on structure and impact strength of metal deposited in electro-slag welding. ***F. F. Benua, I. V. Vologdin, and A. I. Katler.*** *Henry Brutcher Translation No.* 4487, 10 pp. (From *Svarochnoe Proizvodstvo*, no. 5, May 1958, p. 1-5.) Henry Brutcher, Altadena, Calif.

11091 Pressure Welding in Vacuum. Application of the vacuum (10^{-3} to 10^{-5} mm. Hg) pressure-welding process to the welding of hard-metal tips to tools. Some theories about diffusion in metals and alloys. Description of welding setup used. ***N. F. Kazakov.*** *Henry Brutcher Translation No.* 4516, 19 pp. (From *Avtomaticheskaya Svarka*, v. 11, no. 8, 1958, p. 6-18.) Henry Brutcher, Altadena, Calif.

11092 Bonding of Brass to Steel With a Gas Flame. Study of causes of cracks developing in steel being faced with brass. Effect of section shape, bonding temperature, and structure and composition of steel. ***I. A. Nenaezdnikov.*** *Henry Brutcher Translation No.* 4517, 9 pp. (From *Svarochnoe Proizvodstvo*, no. 7, July 1958, p. 35-38.) Henry Brutcher, Altadena, Calif.

11093* Arc Welding Demands Quality Design. Only by basing your operation on quality and economical design will efficient arc welded construction be forthcoming. ***H. Thomasson.*** *Canadian Metalworking*, v. 22, May 1959, p. 40-41.

11094 Low Temperature Stress Relieving of Welded Platework. Method of low temperature stress relieving can be used on any section of welded platework, however large, and at the same time is effective in removing a greater part of residual stresses. ***J. C. Dixon.*** *Engineering*, v. 187, May 15, 1959, p. 651 + 1 page.

11095 Pipe Welding Panelists Pool Know-How; Focus on New Cost Saving Techniques. New procedures stimulate lively discussion at MCAA annual Convention. *Heating, Piping & Air Conditioning*, v. 31, June 1959, p. 97-99.

11096 New, Revised ASTM Specifications Aid Users of Steel Welding Fittings. New and revised ASTM specifications A 234-58a T, A 403-58a T, and A 420-58 T include several changes in manufacture and heat treatment for butt welding and socket welding fittings that are designed to aid the user and manufacturer alike. An important feature is the addition of new quality control requirements for fusion welds of those fittings having seam welds. ***Foster W. Holmes.*** *Heating, Piping & Air Conditioning*, v. 31, June 1959, p. 120-122.

11097* Economics in Designing and Manufacturing of Welded Fabrication. II. Manufacturing: Processes, Material and Design. Author discusses design for welding; he explains process adaptation and economical use of materials. ***John Mikulak.*** *Industry & Welding*, v. 32, June 1959, p. 28-30.

11098* Welding Chrome-Moly to Carbon Steel Calls for Low Hydrogen Electrodes. Warpage and shrinkage are held within 1/16-inch by good joint design and correct preheating, welding and stress relieving procedures. *Industry & Welding*, v. 32, June 1959, p. 31 + 1 page.

11099* Here Are 8 Reasons—You Should Replace Castings With Weldments. Replacing cast parts with welded ones has helped American Pulverizer Co., St. Louis, to reduce manufacturing costs. *Industry & Welding*, v. 32, June 1959, p. 32 + 1 page.

11100* Special Report: Resistance Welding. Advances in the design of machines, controls, and electrodes continue to enlarge the scope of resistance welding applications. *Industry & Welding*, v. 32, June 1959, p. 37 + 21 pages.

11101* New Products Highlight American Welding Society Show. *Industry & Welding*, v. 32, June 1959, p. 62 + 2 pages.

11102 Estimation of Fatigue Life of Welded, Riveted, and Bolted Structures. Concludes that in view of the difficulty of detailed stress analysis as well as the scatter in fatigue data, the dependability of a calculated fatigue strength or fatigue lifetime of a structure may be quite uncertain. Concedes that constant reference to case histories of structures that have been in service will go a long way toward increasing the reliability of calculations in specific design fields. ***Horace J. Grover.*** Paper from "Metal Fatigue", p. 307-324, 1959. McGraw-Hill, New York. (TA460 Si63m)

11103 Welding Titanium. Methods used for successful fusion and resistance welding. *Metal Industry*, v. 94, May 8, 1959, p. 371-374.

11104* The Welding of Heat Resisting and Highly Resistant to Cold Chromium-Molybdenum-Vanadium Steels. Description of welding tests on forged steel 709 by means of classical electrodes with Cr-Mo deposition or with special coated electrodes with Cr-Mo-V deposition or with argon arc. (*In French.*) Soudure des aciers au chrome-molybdène-vanadium résistant à chaud et à résistance à froid. ***E. Pouillard.*** *Métaux Corrosion-Industries*, v. 34, Feb. 1959, p. 58-71.

11105 Welding Redstone. More than 1000 feet of welds go into the construction of the Al casing used for the Jupiter-C rocket and the Redstone ballistic missile. *Missiles and Rockets*, v. 5, no. 24, June 8, 1959, p. 29.

11106* You Can Tote This Pipe Welder to the Job. Developed by Aluminium Limited, it weighs under 50 lbs., welds up to 4" dia. pipe, doesn't need skilled worker. *Modern Metals*, v. 15, no. 4, May 1959, p. 56.

11107* Dynamic Behavior of D.C. Generators for Arc Welding. Proposal for a Definition of "Suitability for Welding". The study is based on oscillographic data giving, in relation to time, arc voltage and current during a welding operation using generators. Investigation of the variations of arc power has made it possible to determine the values of a coefficient defining the suitability of D.C. generators for welding. (*In Italian.*) Comportement dynamique des machines rotatives à courant continu pour le soudage à l'arc. Proposition pour une définition de l'aptitude au soudage. ***A. Carrer.*** *Soudage et Techniques Connexes*, v. 13, nos. 3-4, Mar.-Apr. 1959, p. 114-123.

11108* Methods Improvements Reduce Production Cost of Pole Pieces. Semi-automatic welding, teamed up with stamping, makes better motor pole pieces faster. *Tooling & Production*, v. 25, no. 3, June 1959, p. 59-60.

11109* Welded Construction at Jodrell Bank. In recent years Britain's giant radio telescope at Jodrell Bank Research Station, Cheshire, has become world famous. It is noteworthy that welding has been extensively used in the building of the telescope, particularly on the huge reflector bowl, which is 250 ft. in diameter. *Welder*, v. 28, no. 137, Jan.-Mar. 1959, p. 2-6.

11110* Some Aspects of the Metal Arc Welding of Monel. Although the metal arc welding of Monel is now a firmly established process, each job should be considered on its merits, and it is often desirable to seek skilled advice before welding proceeds. ***M. K. Williams.*** *Welder*, v. 28, no. 137, Jan.-Mar. 1959, p. 7-9.

11111* Spotlight on Arc Welding. XVII. Bell and Webster Ltd., Hoddesdon, Herts. Describes precast concrete products made by Bell and Webster, Ltd. of Hoddesdon, Hertfordshire, England. From the very start, the company has had a progressive outlook and has used welding as part of its policy to ensure that its products are produced by the best methods under carefully controlled factory conditions. *Welder*, v. 28, no. 137, Jan.-Mar. 1959, p. 10-13.

11112* The Metal-Arc Welding of Stainless Steels. I. Welding Metallurgy and Techniques. This series of articles is intended to promote a better understanding of technical recommendations and to assist metallurgists, engineers, and welders with some of the more difficult problems encountered in the metal-arc welding of stainless steels. This part of the series discusses the more important aspects of stainless metallurgy. ***M. C. T. Bystram.*** *Welder*, v. 28, no. 137, Jan.-Mar. 1959, p. 17-22.

11113 Jet Pipe Welding Machine. *Welding and Metal Fabrication*, v. 27, May 1959, p. 202-203.

11114 Inert-Gas Metal-Arc Welding Aluminium Using Fine Wire Electrodes. II. Concludes that the critical current for the spray transfer of aluminum electrodes in argon is a linear function of the electrode diameter; considerably lower welding currents become available as the electrode diameter is reduced below the minimum size now used in equipment in this country. Thus, the minimum thickness of material weldable by the process is significantly reduced, and joints in materials from 0.064 in. to ¼ in. have been welded at high speed. ***J. E. Tomlinson and A. J. King.*** *Welding and Metal Fabrication*, v. 27, May 1959, p. 204-209.

11115 Forty Years of Welding. *E. Coupland and R. S. Pickering.* *Welding and Metal Fabrication*, v. 27, May 1959, p. 214-216.

11116 Cargo Contained, Water Derailed by Hopper Cars Hauling Products Cross-Country. Fabrication techniques and specifications of materials used in production of all-welded super-jumbo hopper cars are described. Over 500 lb. of electrodes and wire were used for each car. ***Ken Rhodie.*** *Welding Engineer*, v. 44, June 1959, p. 48-49.

11117 Resistance Welding of Aluminum Alloys. Discusses basic principles and variables in selection and application of resistance machines for welding Al alloys through a comparison with mild steel welding techniques. ***J. F. Deffenbaugh.*** *Welding Engineer*, v. 44, June 1959, p. 50-52.

11118 An Introduction to Non-Destructive Testing of Welds. Report on the main processes and how combinations of these processes are applied when testing turbine generator components. ***H. B. Norris.*** *Welding Engineer*, v. 44, June 1959, p. 54-55.

11119 Good Mechanical Properties Can Be Obtained Easily When Tig Welding Titanium. Lacking a large Ti-consuming aircraft industry, the author details how other German industries studied, tested and approved Tig welding techniques for joining Ti. ***Helmut van Kann.*** *Welding Engineer,* v. 44, June 1959, p. 58-60.

11120 Consider Residual Stresses When Welding. Tensions created during welding cannot be ignored. Here is an explanation of the reasons why. ***R. E. Holt.*** *Welding Engineer,* v. 44, June 1959, p. 66 + 1 page.

11121 An Evaluation of Mig and CO_2 Welding. In Mig and CO_2 welding, selection of the proper process, or variation, for a particular application necessitates a knowledge of their metallurgical and physical characteristics. G. H. Cotter details and compares these two processes and several variations. ***G. H. Cotter.*** *Welding Engineer,* v. 44, July 1959, p. 22-24.

11122 How to Select Arc-Welding Machines. The manner of metal transfer is the deciding factor in choosing an arc-welder for a specific application. Shows how correlating this factor with the welder's electrical characteristics will determine selection of the welding machine. ***Bela Ronay.*** *Welding Engineer,* v. 44, July 1959, p. 26-29.

11123 Rhode Island's Blackstone River Spanned by State's First All-Welded Bridge. *Welding Engineer,* v. 44, July 1959, p. 30-31.

11124 Sealed, Plastic Transformers Keep Maintenance Costs Low. Resistance welding transformers fail for various reasons, but dirt, moisture, and lubricant accumulations are the most frequent gremlins. Describes development and construction of a transformer unit designed to combat these contaminants. ***William Emaus.*** *Welding Engineer,* v. 44, July 1959, p. 32-33.

11125 Electroslag Welding Procedure Detailed. *Welding Engineer,* v. 44, July 1959, p. 40.

11126 Modified Mig Method Provides Fusion Welds on Thin Materials. Using a constant potential power source with a drooping effect, plus an argon-carbon dioxide shielding mixture, this newest Mig welding-method can produce welds in all types of joints in all positions when joining carbon steel, stainless, Al, Cu, etc. *Welding Engineer,* v. 44, July 1959, p. 47.

11127* Braze Bonding Stainless-Steel Fuel Elements for Nuclear Reactors. Technique developed for joining stainless-steel fuel tubes into rigid bundle assemblies depends upon electroless Ni-P plating of parts. ***P. P. King and R. K. McGeary.*** *Welding Journal,* v. 38, June 1959, p. 241-246.

11128* Corrosion Characteristics of Types 304 and 304L Weldments. Interpretive report prepared under the guidance of a subcommittee of the High Alloys Committee of the WRC summarizes the relative corrosion characteristics of Types 304 and 304L weldments. ***M. W. Marshall.*** *Welding Journal,* v. 38, June 1959, p. 247s-250s.

11129* Vacuum Diffusion Joining of Titanium. Vacuum diffusion processing of titanium components produces joint strength equal to that of base metal. ***E. J. Clark.*** *Welding Journal,* v. 38, June 1959, p. 251s-258s.

11130* Weld Corrosion in Type 316 and 316L Stainless Steels and Related Problems. A report to the WRC High Alloys Committee by the Subcommittee on Weld Corrosion. ***M. E. Carruthers.*** *Welding Journal,* v. 38, June 1959, p. 259s-267s.

11131* Solder Bonding Aluminum to Uranium. This study was undertaken to determine if flat-plate fuel elements could be produced by solder bonding Al sheets to a U core. It was necessary to plate the U with Cr, Fe or Ni, which served as a diffusion barrier. The solders used were Pb, Sn, Zn, and their alloys. No provision was made for removing surface oxides on the base metals. Therefore, it was necessary to plate the Al and the U diffusion barrier. The best bonds were produced with Al plated with 0.5 mil of Cu and Ni-plated U given a Cu flash. Corrosion tests on bonded samples showed Zn was the most corrosion-resistant solder tested. ***H. W. Mishler, J. T. Niemann, R. P. Sopher, and D. C. Martin.*** *Welding Journal,* v. 38, June 1959, p. 268s-272s.

11132* Design Details for Welded Highway and Railway Bridges. The author shows how the flexibility of welded construction enables the designer to exercise his ingenuity and to obtain maximum economy in use of materials. ***Marcello H. Soto.*** *Welding Journal,* v. 38, June 1959, p. 559-564.

11133* Some Consideration on Design for Fatigue in Welded Structures. Paper deals with some of the design practices left from the time when riveting played a predominant role in engineering design. ***J. Koziarski.*** *Welding Journal,* v. 38, June 1959, p. 565-575.

11134* Submerged-Arc Welding Speeds Assembly of Rib Arch Framing. ***B. J. Brugge.*** *Welding Journal,* v. 38, June 1959, p. 582-583.

See also: **10646** (welded ships); **10703** (induction heat treatment of electro-slag welds).

MISCELLANEOUS

11135 Research in Engineering. Discusses time and money necessary for research and development in engineering. ***A. B. Kinzel.*** *Chemical Engineering Progress,* v. 55, Feb. 1959, p. 6 + 1 page.

11136 Foundations of Potential Theory. The present volume gives a systematic treatment of potential functions. It takes its origin in two courses, one elementary and one advanced, which the author has given at intervals during the last ten years, and has a two-fold purpose: first, to serve as an introduction for students whose attainments in the Calculus include some knowledge of partial derivatives and multiple and line integrals; and secondly, to provide the reader with the fundamentals of the subject, so that he may proceed immediately to the applications, or to the periodical literature of the day. ***Oliver Dimon Kellogg.*** 384 pp. 1929. Frederick Ungar Publishing Co., New York. (QA825 K29f)

11137 30 Attributes of the Creative Engineer. III. Mechanics of Creativity. Certain personality traits and intellectual abilities—rounded up in Parts I and II of this series—are essential. But all engineers who rate high on these attributes are not necessarily creative. Often it's a matter of poor technique—the absence of "know-how" in applying the mechanics of creativity. Eight such mechanics for creativity uncovered in a survey of experts are reported in this concluding article. ***Eugene Raudsepp.*** *Machine Design,* v. 31, June 5, 1959, p. 27-30.

11138 Problems the Professional Engineer Faces in Registering in Other States. This article tells how states accommodate the nomadic engineer who wants to be licensed, and what he must do on his own. ***John D. Constance.*** *Machine Design,* v. 31, June 25, 1959, p. 102-104.

11139 Setting Up and Interpreting Engineering Experiments. II. Multiple-Factor Experiments. As the number of variable factors introduced in an experiment increase, the complexity of the experimental setup and interpretation compounds itself. A clear-cut method of coping with these multiple-factor experiments with a minimum of testing and data analysis is pinpointed in this concluding article of a two-part series. After the basic analysis tool, the Latin square, is introduced, two multiple-factor experiments are analyzed. ***William G. Hyzer.*** *Machine Design,* v. 31, June 25, 1959, p. 128-133.

11140 Science and Politics Don't Mix . . . . or Do They? Here is a searching report on the relationship between the technical community, Congress, and the Executive branch. ***Richard M. Koff and Ford R. Park.*** *Product Engineering,* v. 30, no. 22, June 1, 1959, p. 28-32.

11141 Company, Employe-Inventor Relations Improving. Corporation patent policies are more lenient than those of the Government. *Product Engineering,* v. 30, no. 23, June 8, 1959, p. 35-36.

11142 Can There Be Too Many Engineering Shows and Conferences? Pros and cons of this question are discussed by four business executives. *Product Engineering*, v. 30, no. 26, June 29, 1959, p. 36-37.

11143* That Confounded System Performance Measure—A Demonstration. An analog computer demonstration is described in which the performance of three different "man"-machine systems are compared, using an amplifier in the place of the human subject. The demonstration shows that the behavior of a system element cannot always be inferred directly from the performance of a system of which the element is a part. ***F. V. Taylor and H. P. Birmingham.*** *Psychological Review*, v. 66, no. 3, May 1959, p. 178-182.

11144* The Processing of Positive and Negative Information. In this experiment, responses to affirmative information, either true or false, were found to be faster than responses to true or false negative information. ***P. C. Wason.*** *Quarterly Journal of Experimental Psychology*, v. 11, pt. 2, May 1959, p. 92-107.

11145* On Finite Elastic Deformations With a Perturbed Strain-Energy Function. In order to obtain analytical solutions to problems involving finite deformations of elastic solids it is often necessary to adopt a specific form for the strain-energy function. In this paper it is supposed that such a strain-energy function W is perturbed to a new strain-energy function $W + \epsilon W'$ with the result that an additional small deformation is superimposed on the existing finite deformation. ***A. J. M. Spencer.*** *Quarterly Journal of Mechanics and Applied Mathematics*, v. 12, pt. 2, May 1959, p. 129-145.

11146* On the Calculation of Eddy Viscosity and Heat Transfer in a Turbulent Boundary Layer Near a Rapidly Rotating Disk. The distribution of the radial component of Reynolds shearing stress is calculated in the turbulent boundary layer over a rapidly rotating disk, by an integration of the equations of mean flow, the validity of the von Kármán velocity profiles being assumed. ***D. R. Davies.*** *Quarterly Journal of Mechanics and Applied Mathematics*, v. 12, pt. 2, May 1959, p. 211-221.

11147* A Further Note on the Calculation of Heat Transfer Through the Axisymmetrical Laminar Boundary Layer on a Circular Cylinder. By using a Kármán-Pohlhausen method the distribution of local rate of heat transfer is evaluated for the case of air flow in an axisymmetrical laminar boundary layer on a heated circular cylinder, the temperature of the cylinder being independent of downstream distance. ***D. E. Bourne, D. R. Davies, and S. Wardle.*** *Quarterly Journal of Mechanics and Applied Mathematics*, v. 12, pt. 2, May 1959, p. 257-260.

11148 Basic Research in Industry. A count of scientific publications suggests the extent of U.S. industry's effort in basic research. The present analysis bears out the National Science Foundation's observation that most basic research is done in large companies. ***J. C. Fisher.*** *Science*, v. 129, June 19, 1959, p. 1653-1657.

11149 Giving More Public Service. Good business climate depends on good government as well as on good community relations. This article urges metalworking management to become more active in local politics. *Steel*, v. 144, May 18, 1959, p. 99-106.

11150* Tables of the Incomplete Beta-Function. ***Karl Pearson, editor.*** 494 pp. 1956. Cambridge University Press, London. (QA351 P31tb Over.)

11151 Tables of the Incomplete Gamma-Function. ***Karl Pearson, editor.*** 164 pp. 1957. Cambridge University Press, London. (Qa351 P31tg Over.)

11152* The Motivational Approach to Safety. Experienced supervisors realize that motivational techniques are a supplement of their own efforts, rather than a complete safety program. Here's a look at what these techniques can and cannot accomplish. ***James E. Gardner.*** *Textile World*, v. 109, no. 6, June 1959, p. 105 + 2 pages.

11153 Special Block and Line Iterations With Applications to Laplace and Biharmonic Difference Equations. Special iteration procedures for solving systems of a particular form are considered. ***Herbert B. Keller.*** *U. S. Atomic Energy Commission, NYO-8678*, Jan. 1, 1959, 25 pp. (UF767 U3ny Contin.)

11154 Proceedings of the Kentucky Highway Conference, February 17-18, 1959. *E. Everett Elsey, editor.* *Kentucky. University. College of Engineering. Engineering Experiment Station Bulletin No.* 51, Mar. 1959, 154 pp. (TA21 K41.82b Vis.)

11155 Experiments That Have Statistical Certainty. A prototype is built and it works. But problems still exist. For example, to what extent does the new model out-perform previous ones? Also, what variations in performance can you expect for units that will pass production tolerances? Here's how to set up. ***William J. Hill.*** *Product Engineering*, v. 30, no. 27, July 6, 1959, p. 66-69.

11156* A Review of the Relationships Between Personality and Performance in Small Groups. This review has examined a number of relationships between personality characteristics of the individual and the way he behaves or is perceived in groups. Results are cited. ***Richard D. Mann.*** *Psychological Bulletin*, v. 56, no. 4, July 1959, p. 241-270.

11157* Shape-Preserving Solutions of the Time-Dependent Diffusion Equation. Exact solutions to the time-dependent diffusion equation are exhibited which correspond to the diffusion-limited growth of ellipsoidal precipitate particles with constant shape and dimensions proportional to the square root of the time. ***Frank S. Ham.*** *Quarterly of Applied Mathematics*, v. 17, no. 2, July 1959, p. 137-145.

11158* Asymptotic Developments for a Boundary Value Problem Containing a Parameter. Paper points out a curious type of singularity which can arise in perturbation of solutions of boundary value problems containing a parameter. We shall consider two such problems each for functions of x and y continuous in $y \leq 0$, (x,y) bounded, and harmonic in $y < 0$. ***Richard C. MacCamy.*** *Quarterly of Applied Mathematics*, v. 17, no. 2, July 1959, p. 155-163.

11159* Algebraic Topological Methods for Contact Network Analysis and Synthesis. Use of Boolean algebra in analysis and design of contact networks was introduced by C. Shannon, and for series-parallel circuits the problem was completely solved. However, for circuits of a more general nature, e.g., bridge networks, the design problem was not solved and rules given for analysis depended on special geometric constructions carried out on the circuit diagram. It will be shown that contact network theory can be based on topological considerations and topological methods for analysis and synthesis will be given. ***Charles Saltzer.*** *Quarterly of Applied Mathematics*, v. 17, no. 2, July 1959, p. 173-183.

11160 Imprinting. An effect of early experience, imprinting determines later social behavior in animals. Our best guess to date is that it is a rigid form of learning, differing in several ways from the usual association learning which comes into play immediately after the peak of imprintability. ***Eckhard H. Hess.*** *Science*, v. 130, July 7, 1959, p. 133-141.

11161 Decentralized Science Plan Approved by Soviet Academy. Planning and administrative authority for most programs and projects will be transferred to the research institutes that actually do the work. This change, which resulted from the recent annual meeting of the Soviet Academy of Sciences, reflects a major shift in Soviet policy. *Science*, v. 130, July 24, 1959, p. 208.

11162 Mathematical Games. About phi, an irrational number that has some remarkable geometrical expressions. ***Martin Gardner.*** *Scientific American*, v. 201, no. 2, Aug. 1959, p. 128 + 4 pp.

11163 The Scientific Revolution. Challenge and Promise. Opens with a discussion of the scientific revolution and its implications, moves to an appraisal of the problems we face in developing a science program adequate to the nation's needs, and then to an assessment of the role of science in society and of the effect a lack of public understanding is having upon science and the scientist. ***Gerald W. Elbers and Paul Duncan, editors.*** 280 pp. 1959. Public Affairs Press, Washington, D. C. (Q127.U6 EL16s)